THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1610.] LONDON, MARCH 20, 1894. [46TH YEAR. PRICE 6d.

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Gives a light of
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Brilliant Light.

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Special Lamps constructed for Outside Lighting and Street Lighting; and Large Clusters of Lights made for Lighting Halls and large Areas from one centre.

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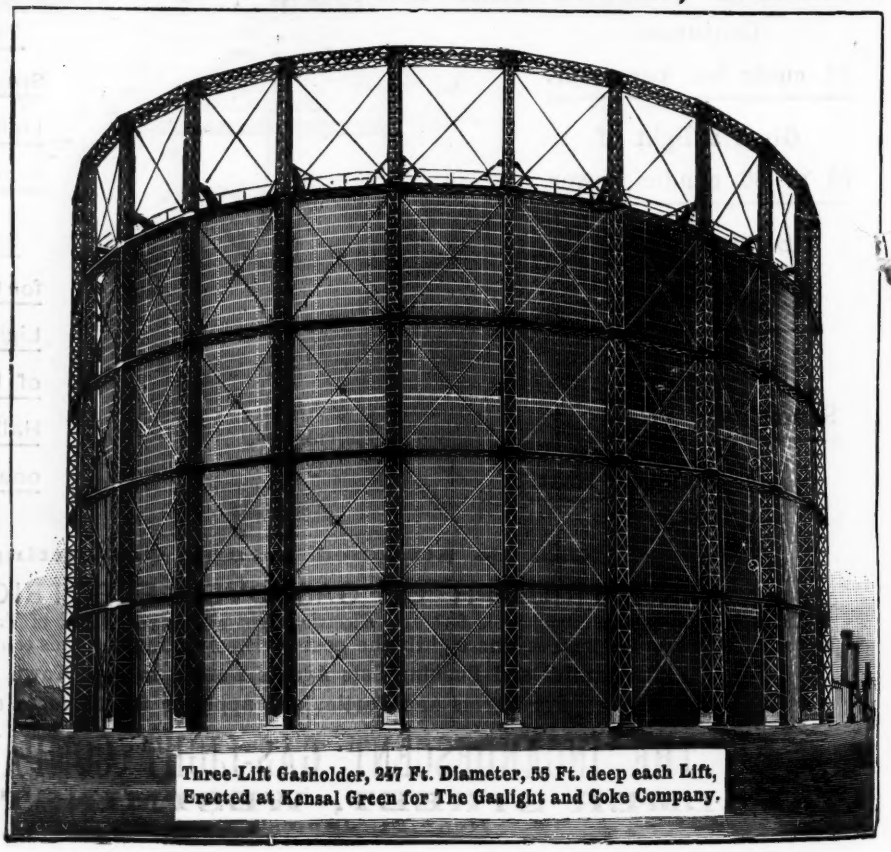

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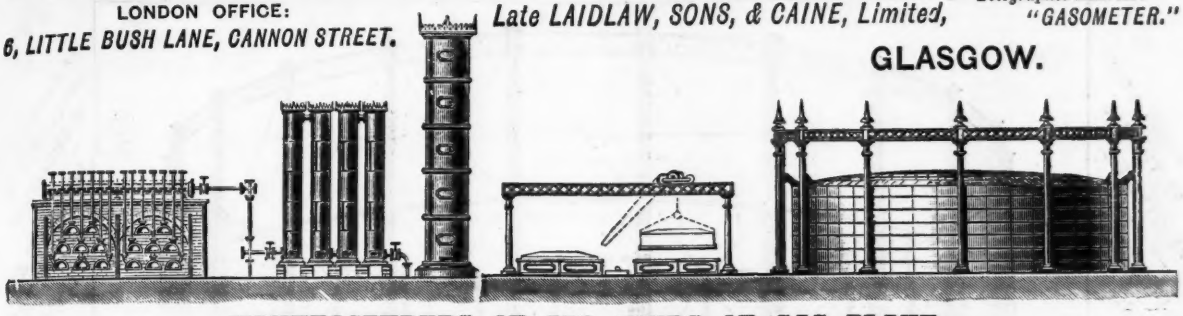

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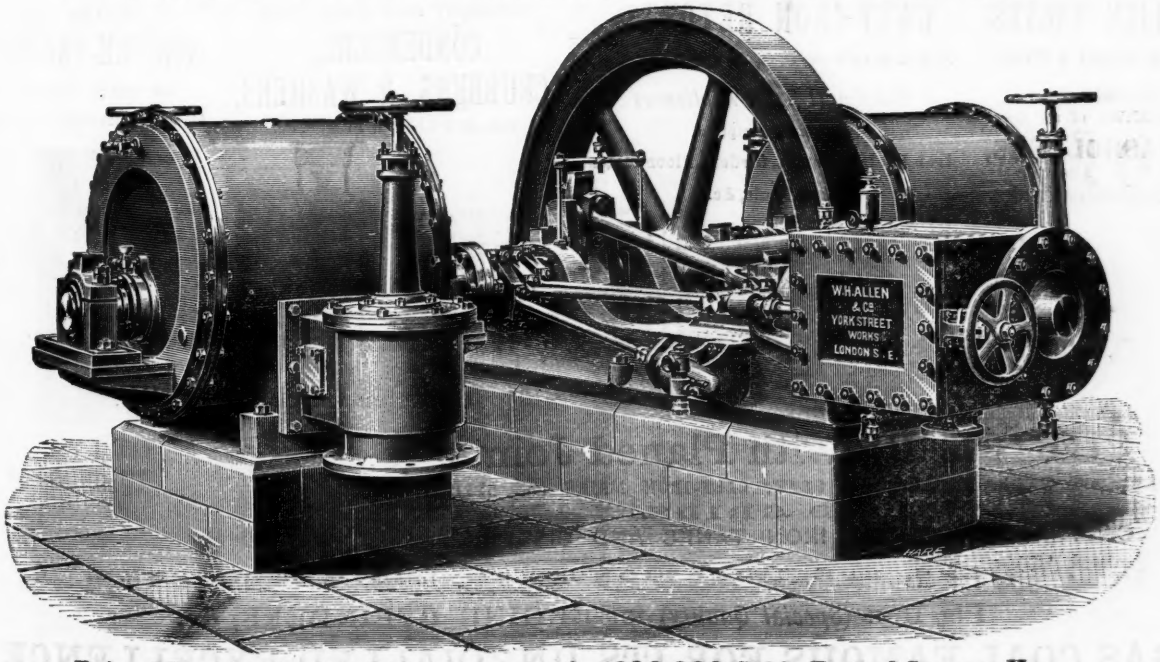

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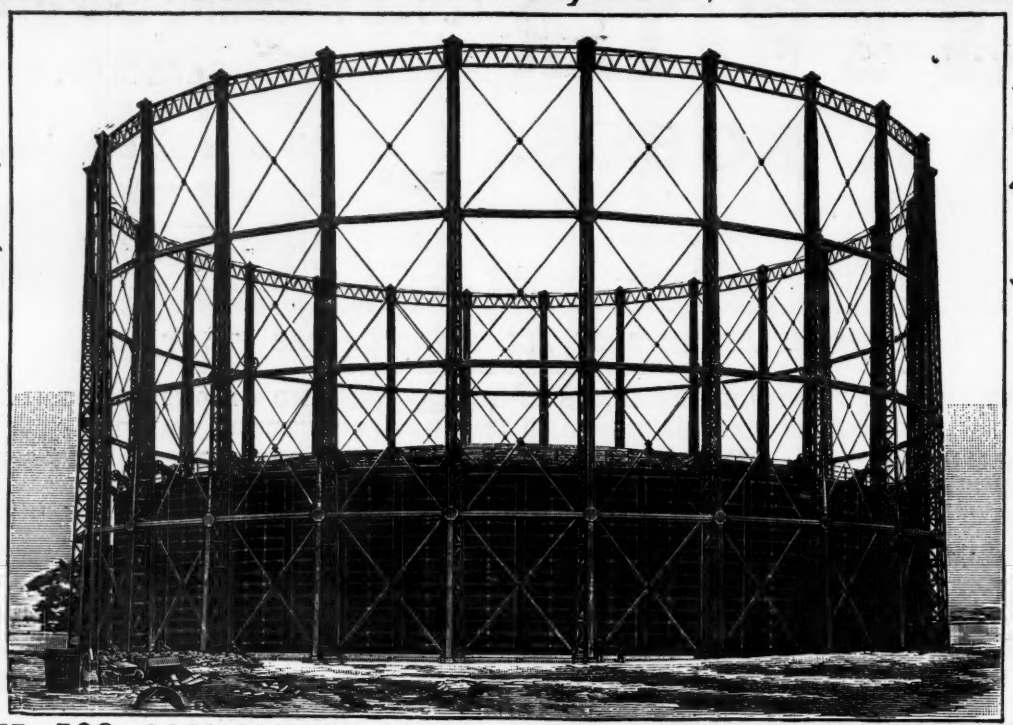

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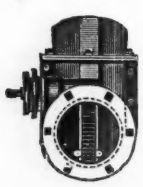

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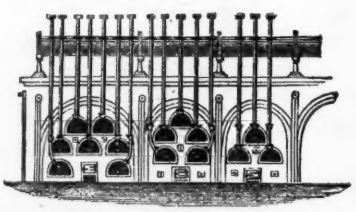

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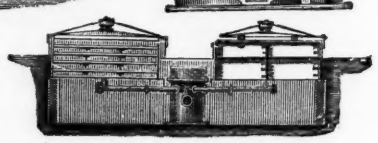

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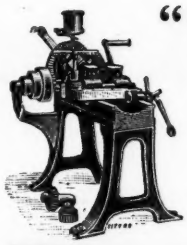

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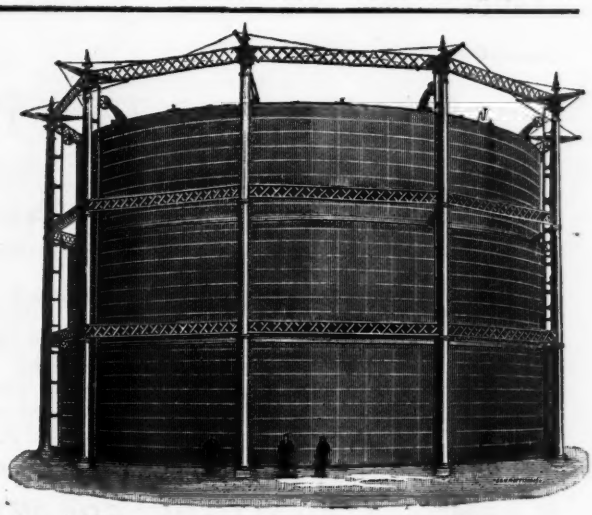

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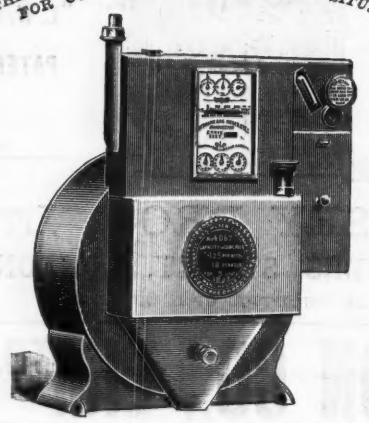
PENNY-IN-THE-SLOT GAS-METERS.

THE AMOUNT OF GAS GIVEN IN EXCHANGE FOR COIN CAN BE ALTERED *IN SITU*.



The persistent efforts of the Inventors of our Meters have been crowned with

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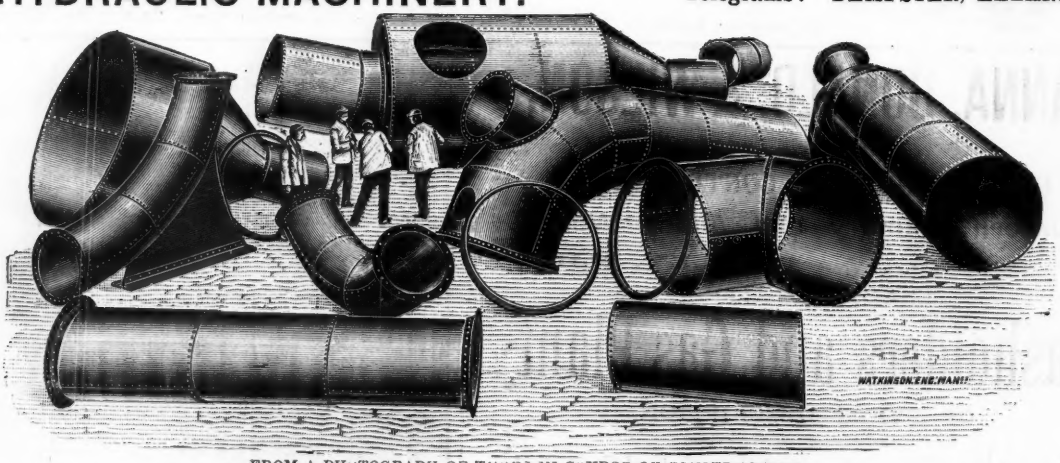

FROM A PHOTOGRAPH OF TUBES IN COURSE OF CONSTRUCTION.

STEEL INLET AND OUTLET PIPES. DUCKFOOT BENDS. FOUL MAINS, &c.

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"STANDARD" WASHER-SCRUBBERS

These Washer-Scrubbers have recently been IMPROVED by alterations having been made in the form of the Washing Devices, by means of which a great increase in the wetted surface is obtained, with corresponding increased efficiency of the Machines.

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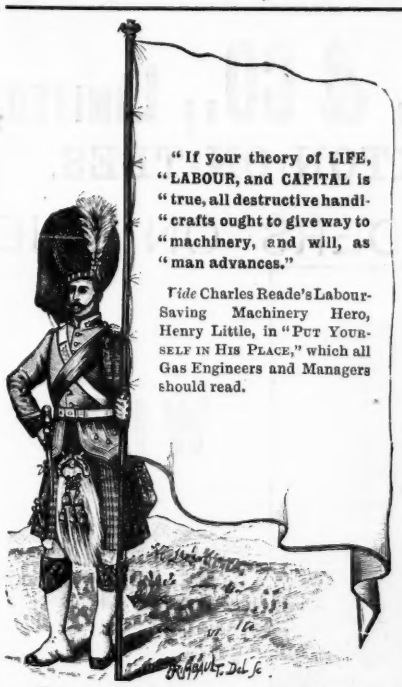

"If your theory of LIFE, "LABOUR, and CAPITAL is "true, all destructive handi- "crafts ought to give way to "machinery, and will, as "man advances."

Vide Charles Reade's Labour-Saving Machinery Hero, Henry Little, in "PUT YOURSELF IN HIS PLACE," which all Gas Engineers and Managers should read.

Telegrams: "LABORLESS, LONDON."

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Automatic Retort-Houses.	
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SOLE MAKERS OF GASHOLDERS ON THE

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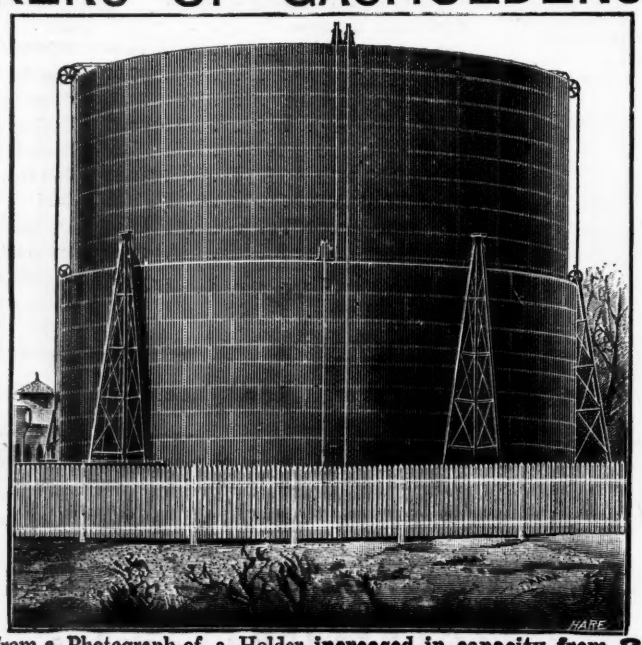

WIRE ROPE SYSTEM

This Engraving is taken from a Photograph of a Holder **increased in capacity from 32,000 cubic feet to 59,000 cubic feet** by the addition of a Lift. The Ropes are applied to both Lifts to supplement the Standards.

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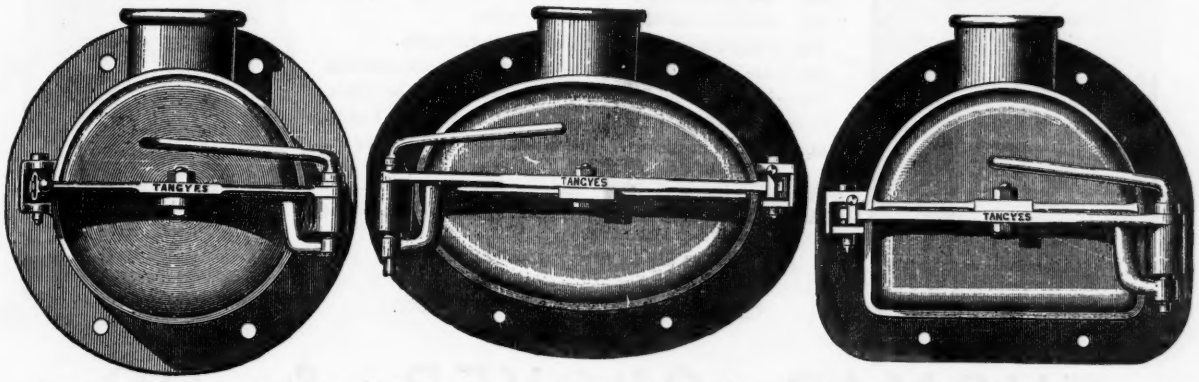
MORTON'S SELF-SEALING RETORT-LID,

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



These Retort Lids and Fastenings are made in three forms, round, oval, and ⊓ (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these Lids are recommended to make their selection, in order to avoid cost of pattern-making, delays, &c., &c.

QUOTATIONS WILL BE GIVEN ON RECEIPT OF PARTICULARS OF REQUIREMENTS.

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These Washers are guaranteed to present a larger area of Wetted Surface (size for size) to the action of the Gas than those of any other Maker.

Results unapproached by any other system. *References and full particulars on application.*

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[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

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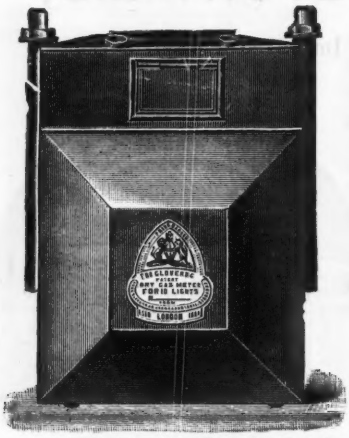
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

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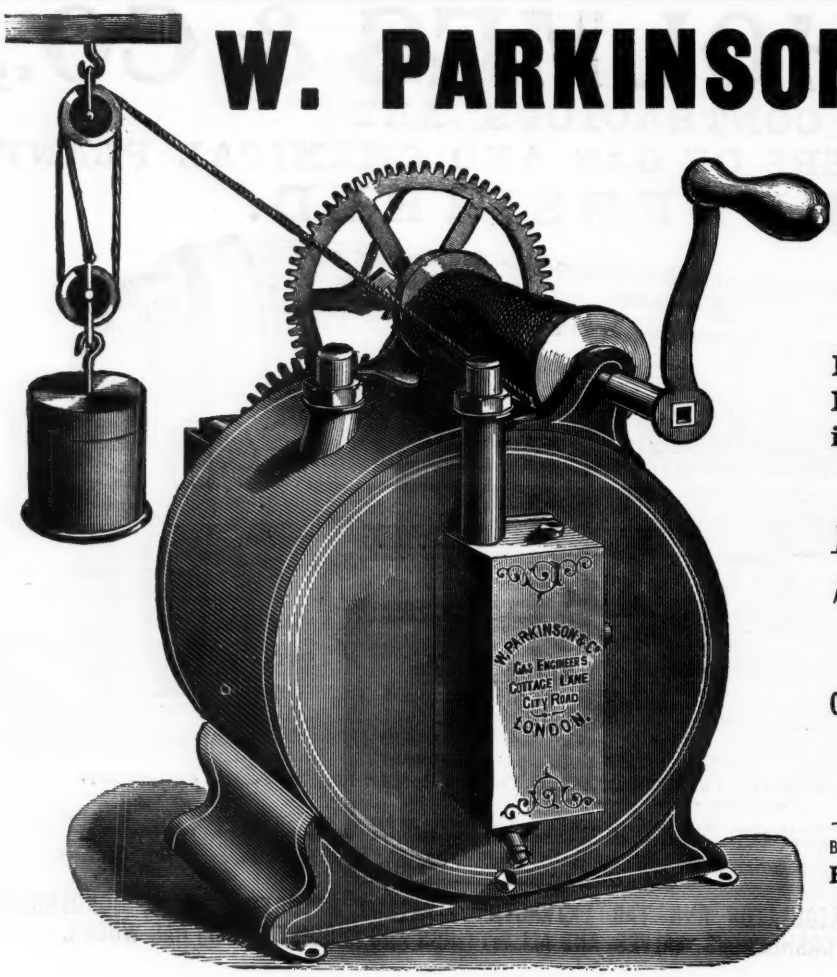

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For use in Low-Lying Districts, or wherever increased Pressure is required.

For supplying Cooking-Stoves, Gas-Engines, &c.

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TELEGRAPHIC ADDRESS: "INDEX."

BELL BARN ROAD WORKS, **BIRMINGHAM.** *Telegraphic Address*: "GAS-METERS."

10, MAWSON'S CHAMBERS DEANSGATE, **MANCHESTER.** *Telegraphic Address*: "PRECISION."

[See also Advt., p. 552.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

EASTER HOLIDAYS.

Owing to the Easter Holidays, it will be necessary to go to press earlier than usual with the next number of the JOURNAL. We shall therefore be obliged by correspondents forwarding communications intended for that issue so as to reach us not later than FRIDAY, the 23rd inst.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Telegraphic Address: "GASKING LONDON."
Telephone Number: 2759.

TUESDAY, MARCH 20, 1894.

An Unnatural Coalition.

WHEN noticing the proposal for the formation of a "ring" in the northern gas coal trade, we observed that a scheme of this character would be certain to receive the support of the Miners' Federation, as being a proceeding exactly in accord with the ideas of the leaders of this organization. It is worthy of remark that we have not had to wait long for proof of the accuracy of this prognostication; for it has been reported that the officials of the Fifeshire miners have advised the men to strike at two collieries, so as to compel the coalowners to join the Employers' Association for maintaining prices. Upon this news a contemporary offers the comment that it is "a curious phase of a strike, "the most curious that has ever been known." It is not quite clear what had better be the issue of such a transaction, in order that those who commit themselves to it, and the lookers-on, may derive the greatest benefit from the experiment. The opportunity of carrying out experiments in political economy is one of the needs of the age. It is useless for students who are content to derive their information at second hand to essay in turn the task of instructing the men of action, either on the side of the employers or of the employed. The former party, being, as a rule, the better educated, do not scout the very notion of the existence of a theory of industry and commerce. But, as they have recently shown, they are not proof against the temptation to repeat tricks that have been exposed times without number. The miners, or rather their leaders, are endowed with such a stock of comprehensive ignorance, that they are quite ready to try anything which occurs to them at the moment as promising to gain their ends. The worst of it is that when such men do try an experiment, they are usually incapable of rightly interpreting the results, whatever these may be. This is especially true of the results of those experiments called strikes, which are usually directed to ascertain the rate of payment that is obtainable for doing some kind of handiwork. The issue is generally obscured, and old Kaspar's notions respecting the rights and wrongs of the Battle of Blenheim are lucidity itself in comparison with the opinions entertained by the participators in a long strike—particularly if it fails—as to the causes of the catastrophe. There is something very ludicrous in the idea of workpeople forcing their employers into a "ring" with others, in order that the value of the product and the rate of wages may be maintained at the expense of the public. Every penny captured from the people by such an unnatural coalition (no pun is intended) is of the nature of plunder; and what is most likely to happen when the spoil is divided? Each party will accuse the other of acting unfairly, and there will be a fall-out. If this should eventuate in a strike, the miners would go cap in hand to the very public they have conspired against, and beg for assistance to fight their quondam partners. And all this is the scheming of hard-headed Scotchmen, who are nothing if not practical. Shade of Adam Smith, how thy countrymen dishonour thee!

The Gas Affairs of Sheffield.

THE position of the Sheffield United Gaslight Company during the past half year was one of exceptional trial and difficulty, from which the Directors were only able to watch the extrication of the undertaking at the sacrifice of the substantial sum of £14,723 out of the reserve fund. Sir F. Mappin, the Chairman, had a lugubrious message to lay before the proprietors at the recent general meeting, the report of which will be found elsewhere; but the proprietors received it with praiseworthy equanimity. It was a new thing for them to hear of a falling off of 7·22 per cent. in gas consumption for the half year; but they must have been prepared for some such announcement, and also for the account of the ransom price paid by the Board for coal during the latter days of the strike. The fact probably is that the trade of the town has suffered so heavily from the strike, that the condition of the gas undertaking presents a bright and comfortable aspect in comparison with the majority of other local industrial and mercantile concerns. The meaning of a coal famine has been brought home to the people of the Sheffield district in many forms, not the most agreeable of which is the advance of 3d. per 1000 cubic feet which the Board have been compelled to make on the selling price of gas. The Board have assured the City Council that the advance is not meant to be a permanent increase of the cost of gas in the district; but it is only common prudence on the part of the Company to say nothing about taking it off until the coal trade can be said to have returned to a settled state. The best proof that can be given of the vitality and recuperative powers of the Sheffield or any other gas undertaking is the continuous growth of the number of meters and stoves connected with the mains. Notwithstanding all their troubles, the Sheffield Company have

nothing to complain of in this regard. No gas company can be rightly said to have encountered a check in their career so long as there are more meters sent out than came back into store.

Good Work at Leicester.

THE Leicester Corporation gas undertaking has done remarkably well during the past year. When making his financial statement to the Town Council this day week, Alderman Lennard, the Chairman of the Gas Committee, was able to disclose the gratifying fact that the amount of the net profit realized for the year was only £380 less than that obtained in 1892, and this notwithstanding a decrease of 3½ per cent. in the gas consumption, without which no gas undertaking would be in the fashion. The result was due to several causes, not the least important of which appears to have been an accumulation of coal in the shape of surplus stock, the savings of ten years, and amounting to 7000 tons, which did not stand to the debit of the undertaking. It is not given to every Works Committee to find their coal stock so far to the good at a pinch. More commonly it is the other way. Besides this, the Leicester people have acted precisely as we recently predicted would be done in a supposititious case —they have slightly sacrificed illuminating power and tar, and pushed the make of gas to a higher average yield, and so were in a position to weather the storm. Moreover, they were able to pull through without increasing the price either of gas or of coke, or cutting down expenditure on repairs and maintenance. Alderman Lennard spoke of their coke sales in an admirable spirit. He claimed, truly enough, that, if they had so chosen, the Committee could have made more of their coke than they did, merely by taking full commercial advantage of the situation last autumn, and raising the price. But, he said, "having regard to the fact that the coal famine was pressing "very severely on the poor of the town," the Committee decided to keep to the old prices. Naturally, "this action "proved a great boon to the poor, who assembled at the "gates every morning in large numbers; being dependent "on the Gas Department for their sole supply of fuel." Surely, while the laws of political economy are being set at naught right and left in the vain hope of advancing selfish interests, this merciful breach of the rule of "buying cheap and selling dear" will not be charged heavily against the Leicester Gas Committee. Rather, on this and other accounts, do we feel constrained to cry: "Bravo, Leicester!" and to congratulate everybody concerned in the administration and working of the Gas Department of this exceptionally well-managed town—from Alderman Lennard and Mr. Alfred Colson down to the youngest hand on the executive staff—upon the splendid justification of municipalization which they are displaying before the world. If the Corporation would only refrain from taxing the gas consumers higher than other ratepayers—applying some of the money in the reduction of their heavy capital obligations—we should be disposed to rank them in the very first line of local authorities of this or any other country or period.

Dr. E. G. Love on Standard Candles.

THERE are few more careful or more interested students of the niceties of gas photometry than Dr. E. G. Love, the Gas Examiner for New York; and therefore much interest attaches to the results of the investigation this painstaking official has made into the characters of the standard candles imported for use in testing the New York gas supply. The recent prescription for candle-making issued by the Metropolitan Gas Referees appears to have aroused in Dr. Love a legitimate curiosity to learn how far the candles actually to his hand corresponded with the new requirements; and accordingly he explored the inwardness of a collection of samples of the articles with a ruthlessness that knew no bounds. One can imagine a candle manufacturer reading with some consternation Dr. Love's account of his investigations. Candles are made to burn, of course, not to have their wicks melted out of them and then examined in this cold-blooded fashion. Time was when an English parliamentary standard candle was bought by the label; and there was an end of care in the matter. But things are managed differently now. The Referees have been constrained to propound and answer the conundrum: "When is a candle not a candle?" And Dr. Love has tested the old stock by the new prescription, with the somewhat disquieting result that not one of his specimens has been found to satisfy the requirements. He knew before, he says—evidently more in sorrow than in anger—that candles sold as six to the pound never by any chance weigh one-sixth of a pound each; but when neither wick nor weight nor composition is according to standard, what is to be said about it? When the wise man of old went in search of a virtuous person, he took a candle with him. Now-a-days apparently it baffles both human wisdom and virtue to find an honest candle.

Private Members' Bills.

PARLIAMENT has been getting to work again with a degree of energy highly creditable to honourable members so lately dismissed from what was fated to be unprofitable toil. Again the indefatigable private members with little Bills under their charge have sought the assistance of the House in the matter of getting these measures ordered in, presented, read the first time, and printed. "Hope "springs eternal" in the breast of the member with a mission; and he is ready to permit a grateful country to print his schemes of legislation year after year in the expectation, commonly vain, of seeing them passed before he himself passes away from the scene of his public labours. This session has commenced with a large promise of remedial legislation standing in private members' names, much of it of familiar aspect. For instance, the Mines (Eight Hours) Bill is well to the front this time—being down for second reading on April 25. There is a project for amending the law relating to Patent Agents; as to which it might be remarked by a flippant observer that a good many Patent Agents need amending quite as badly as the law relating to their position in the community. The good old Rating of Machinery Bill is twenty-first on the list, and is to be read a second time on May 9. A Bill "to establish a Ministry of Labour, to be "presided over by a Minister to be called the Labour "Minister," is also to be one of the first-fruits of May, if Fate and circumstances permit. A measure providing for certificates for persons in charge of steam-engines and boilers is not to be overlooked. The Railway and Canal Traffic Act, 1888, is to be amended; the forty-eight hour week is to be rendered obligatory upon the cotton trade; Scotch coal miners are to be nationally insured; Boards of Arbitration and Conciliation in Trade disputes are to be set up; municipal authorities are to be empowered to work their own tramways; and a number of other statutory aids to the inauguration of the millennium are to be considered at different dates between now and June next. It is all very promising, no doubt; but a good many things fatal to the aspirations of private legislators may happen before May comes and goes. Parliament starts the session a good month behindhand as it is; and for more reasons than this, the prospect of any private member carrying through an Act this year which shall be called by his name, is slight enough. It was not always thus. There have been periods in the history of Parliament when a great deal of the legislation effected was due to the initiative of private members; and some very good laws have come into existence in this way. Times are changed, however, and now-a-days either Government initiative or Government support is almost essential to the successful enactment of a project of law that is worth passing at all. We are not sure that the change is altogether for the better. It tends to make administrations more autocratic, and to damage the fine old independence of individual members by which in past times the most despotic of Ministers was kept in check, and never allowed to forget that in the House of Commons all the seats are equal.

Standards of Value and Measurement.

IT would be an interesting and instructive labour if some competent authority would address himself to the task of tracing out the influence of the accidental and the fortuitous upon the development of the arts and industries of civilized man. The work would be of enormous difficulty, and could never be brought to an end; it is by no means easy to say where it could be begun. But what a long vista for reflection the very mention of the idea opens up! One thinks immediately of the origin of all the old weights and measures, and of the innumerable ways in which manufacturers have been governed by the measurement of fundamental elements according to simple, easily-remembered data. Was not the standard English railway

gauge fixed for ever by the accidental circumstance of the colliery waggons having been built to it before steam haulage was introduced? Our furlong is only the Anglo-Saxon "furrow-long" written short; and it was simply the distance that an average ox-team could be driven in the plough without stopping to breathe. The curiously odd length of the "rod, pole, or perch" was just the length of the goad by which the primitive husbandman was able to control his lumbering team; and what more natural than that he should occasionally use it as a measuring-stick? It must have been noticed how easily these irrational old units of measurement stick in the memory, and with what a degree of effort most men assimilate the so-called scientific weights and measures of the metric system. After all, it is only the decimal multiplication and subdivision of the metric units that recommends the latter to the civilized world. It is the "compound" arithmetical operations that we would like to be saved from the necessity of working out. If this could be done consistently with the retention of our traditional and essentially rational, because naturally derived units, it would be a good thing. We cannot do this, however. It is idle to suggest the decimalizing of our actual weights, measures, and money. If we are to change, we had better fall into line with the Latin Union, and adopt the metric system *en bloc*. Yet it will be long before the British people does this; because our common units of weight, measurement, and currency are so much more convenient than the metric substitutes. Merely as a question of writing down figures, the conversion of the English sovereign into coins of a denomination equivalent to the franc or the mark would not save anything. And what a dislocation of domestic finance there would be if things could no more be bought by the shillingsworth or pennyworth, if the familiar and convenient pound were to swell into the cumbrous kilo., and the sturdy quart shrink to the litre! A curious example of the influence of a coin upon the valuation of a commodity is supplied by the contemporary agitation in the United States for "dollar gas," which has given many Gas Companies an amount of trouble they would gladly have been spared. There is no connection between the dollar and a thousand feet of gas The former simply represents a handy round figure, which has "caught on" to the popular fancy as being a reasonable price for gas. This is pure accident. If the dollar were worth 4s. 6d. or 4s., it would still be favoured as the popular figure; the protests of the companies would not be regarded in any case. Fortunately for us, there is no such unit of value in the English currency to tempt the few survivors of the race of gas agitators to raise an unjust but catching cry. The incident, as it has been illustrated in the experience of the American gas industry, is worthy of notice, as repeating in a modified form the aboriginal process whereby all standards of measurement and value were established by common consent.

Regulations by the Board of Trade for Preventing Electrolysis of Gas and Water Mains.—Various Acts of Parliament and Provisional Orders granted last session, authorizing the use of electric traction on tramways, impose on the Board of Trade the duty of prescribing regulations to be observed by the tramway companies for the prevention of injury to gas and water pipes, and for minimizing interference with other electric circuits. After hearing the various parties interested, the Board decided to prescribe regulations; and these have now been issued.

The London County Council and the Metropolitan Water Companies.—A report from the Water Committee comes before the London County Council to-day, stating that they have communicated with the Water Companies, asking whether they would enter into negotiations for the sale of their undertakings on the basis of the resolution recently passed by the Council. The Lambeth and the New River Companies had merely acknowledged the receipt of the communication; the Grand Junction Company stated that they were not willing to enter into such negotiations at the present moment; the Southwark and Vauxhall Company said they had no intention or desire to sell their undertaking; and the East London Company explained that they did not see their way to enter into negotiations on the basis indicated, but that if definite and practical proposals were made for the purchase of their undertaking, they would be prepared to give them careful consideration. With regard to the Bills of the Southwark and Vauxhall, the West Middlesex, and the East London Company, the Committee recommend that they should not only be petitioned against, but that steps should be taken to obtain their rejection on the motion for the second reading.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 538.)

Business during the past week on the Stock Exchange has been more happy than the average for some time past. Not that in point of magnitude it shows any giant stride, for transactions were far from being extensive on the whole; but there was a quiet favourable tendency which was gratifying, even though it did not hoist prices up sharply. On the opening day, Consols were done at the "record" price of par *ex div.*; but it could not stay, and the closing figure was ¼ worse. Most of the other leading departments were firmer; Americans notably so, although the downward course of silver might have militated the other way. Home rails—a good trade barometer—were firm; and in the Foreign Market, there was a revival of South Americans, owing to progress made towards a solution of the Brazilian fix. The settlement went smoothly, and produced no complications. Money was in fair demand, so long as Stock Exchange requirements lasted; but the discount market is very slack, and the Bank reserve is higher than ever. The Gas Market was fairly active on some days; but the aggregate for the week showed no more than average business. The tendency was favourable; and several choice stocks are a little dearer. In Gaslights, the "A" was a good bit dealt in. But it exhibited no disposition to rise; and one or two bargains were marked as low as 233. Few of the secured issues showed any activity; but the "H" 7 per cent. limited was the most prominent, and it rose a point. Of South Metropolitans, the "B" alone was conspicuous, rising steadily and closing at an advance of 3. Commercials were quiet and strong; and the old stock advanced in value—a dividend being payable on the 5th of next month. Very little of anything in the Suburban and Provincial department changed hands; but prices were excellent generally, and several issues went up in price. The Continental Companies were remarkably quiet, and quite destitute of any feature whatever. Among the undertakings located in more distant parts, the only incident to be noted was the sharp rise in Chicago bonds, borne up by the increasing demand for all stocks having a good guarantee behind them. The Water Companies were very quiet, and somewhat disposed to droop. Only one or two changes in quotation occurred; but they were for the worse.

The daily operations were: The Gas Market opened without alteration, and continued firm and mostly unchanged; the only moves being a rise of ½ in Alliance and Dublin 7 per cents. and the advance in Chicago noted above. Tuesday's transactions were extremely limited; but still the tendency was upward. Commercial old gained 2; Brentford new, 1; Bromley old, 1; and ditto new, ½. Business continued quiet on Wednesday. Gaslight "H" was in demand, and rose 1. Thursday brought no increase in activity, and quotations remained unchanged. Friday's transactions were more extensive; and South Metropolitan "B" improved 3. In Water, New River fell 2; and Southwark ordinary, 3. Saturday was quiet, as usual; and no further movements took place.

ELECTRIC LIGHTING MEMORANDA.

The Earnings of Central Supply Stations—The Conditions of Profitable Central Station Working—A Prophecy and a Criticism.

The problem of how to increase the earnings of central supply stations is one that does not appear to be susceptible of solution by the simple ambulatory method. When such undertakings were originally started, the first responsibility of their managers was to keep them going at any cost. Then came the study of economies in the working; and it was not long before the ominous phrase "load factor" became recognized as meaning something of capital importance in regard to the commercial prospects of such concerns. Before this consideration, all questions of choice of system and pattern of plant seemed insignificant; and the solicitude of the technician to screw dynamos and engines up to the last peg of efficiency appeared like mere scientific play. Recently *Industries and Iron* devoted an article to the subject, in which admission was freely made that "the filling out of the load diagram is a matter that calls for the greatest possible care and power of discrimination, for the simple reason that any possibility of increasing the height of the peak in the load curve must be avoided at all costs." This is undoubtedly the main point. It is all very well to take measures for raising the day load; but what is to be done when the day and night loads are compounded, as must happen many times during the winter months? The same consideration has been discussed in gas circles in connection with the sale of gas for cooking and heating, although the matter has naturally been presented to gas-works administrators in a less urgent fashion. It has, however, been recognized that the expediency of encouraging the consumption of gas by means of cooking-stoves depends entirely upon the circumstance of the heaviest kitchen demand coming in most communities in the middle of the day. It is the midday dinner that renders the stove consumption welcome to the gas manager; and even he finds it a trouble now and again in the depth of winter, when he would fain keep down the day pressure in order to strengthen his reserve of gas in the holder for the night. In a community

where late dinners were the general rule, the gas-stove consumption would have no claims for favourable treatment in the matter of price. Hence it is not to be wondered at that the prospect of rendering central electric lighting stations more profitable, by making the plant do work other than lighting, is regarded by far-seeing critics as illusory. Our contemporary already mentioned goes so far as to state that "the average load factor may be taken as something between 10 per cent. and 30 per cent. in existing central stations; and, having regard to the fact that ideal demand conditions can never obtain, it seems very doubtful whether any great advance on the best existing load factor could prudently be made." It must be admitted that this is not a cheering reflection for those whose money is sunk in such undertakings.

The argument upon the foregoing reflection goes to prove that the only possible way to make central lighting stations pay better lies in cultivating the broad principle of encouraging non-conflicting and discouraging conflicting demand. Thus, theatre lighting can be safely treated as balancing private house and office lighting fairly well all the year through. The best conditions for profitable supply would be constituted by a heavy office demand during the day, followed by a good theatre and private house consumption for the early evening, and a brisk hotel and restaurant demand up to about midnight. This scheme knocks on the head all projects for distributing electricity for motive power at low rates, unless such subscribers would submit to be left in the lurch whenever it might suit the convenience of the supply company to cut them adrift. It is argued that, instead of running after this latter embarrassing class of connection, central supply companies would do better to look up "ill-lighted warehouses, underground city restaurants, vaults, or wine-cellars used only in the ordinary course of business." Unfortunately, this field of enterprise is not large.

Mr. Tesla's brilliant experiments in the production of light apparently without wires, and by high-speed alternating currents which seem able to hurry through the human body too fast to hurt, have been responsible for a vast amount of delusion on the part of the large number of would-be ingenious persons who are hunting for "the light of the future." Many people have got hold of the idea that light-waves are only electro-magnetic waves speeded up; and accordingly it is gravely suggested that all we have to do, in order to get light for next to nothing, is to drive one piece of electro-magnetic machinery by another until the necessary velocity is attained. How light produced in this way could possibly be cheap, is not very clear. But, of course, the idea is the thing; and if the result could once be obtained, it might be left to practice to reduce working expenses. Electricians are so good at this kind of thing! An electrical contemporary, referring to these dreams, points out that, although mere speeding up might not present an insuperable obstacle in the way of their realization, long before vibrations of the kind in question would give the effect of light, all known conductors would become impervious to them, and insulation would fail. Hence the conversion would need to be carried out where the effect was desired to be produced, which is obviously an awkward condition.

In connection with this perennially attractive topic, we may mention that Lieut.-Col. Elsdale has an article in the *Contemporary Review*, setting forth four of the leading problems of physical science which he thinks will, in all probability, be solved in the next generation, if not in our own. The conquest of the air is the first of these problems; and the conclusion is arrived at that, if the rate of progress of the last thirteen or fourteen years is kept up for a similar period in the future, aërial navigation will be an accomplished fact. Something special in the way of gas or electric motors will be required to bring this about. The second of the problems is the reduction of the surface or skin friction which at present absorbs so much of the power required for driving vessels through the water, and consequently makes a ship compare so unfavourably with fish and marine animals in this regard. The third problem is stated to be the reduction of coal, by some simple and practical process, to a condition in which it will, when brought into conjunction with the inexhaustible reservoir of oxygen in the atmosphere, give us the necessary elements for the production of an electric battery. The last question is how to reduce the vegetable foods which at present are only adapted to the use of animals to a condition suited to the human digestion and the human palate. As will be conceded, there is nothing small or petty in any of these propositions. Their propounder ought to collaborate with M. Jules Verne for the production of a fancy picture of what the condition of the kingdoms of the earth is likely to be when all, or even any of his problems shall have been definitely solved. There is some comfort in the thought that the working out of the third of them should afford occupation to both gas engineers and electricians—the former to treat the coal, and the latter to do the rest. There is no harm to be feared, while there is a considerable amount of amusement to be gained, from exercises of this nature. But when it comes to asserting a belief that any observer now living can forecast either the problems of the science of the future or the approximate period of their solution, we beg leave to retreat into a position of the most extreme reserve. All experience tells us that the world's work is not done thus. Nobody in the end of the sixteenth century divined that the need of the following age was a new source of power; nor did gas or railways come because they were generally supposed to be wanted. A quarter of a century ago people now in the plenitude of their powers of speculation and work were not aware of the need for electric light. He is rash who essays to map out the line upon which the infinite spirit of the human race will take a new departure, even in the future of a day ahead.

JOHN HUTCHINSON.

We announce with much regret, which will be shared by a wide circle of readers, the death of Mr. John Hutchinson, the Secretary and Manager of the Barnsley Gas Company—a gentleman who has been for many years most honourably associated with the gas industry.

Born at Upper Hough, Wentworth Woodhouse, near Barnsley, on the 9th of February, 1823, Mr. Hutchinson had reached the ripe age of 71. Originally intended for the linen trade, then the staple trade of Barnsley, he entered upon a seven years' apprenticeship with a linen dealer of the town. But before the term had elapsed, his employer got into financial difficulties, and his apprentice was glad of the opportunity this afforded to quit a calling which was never congenial to him. We next find him installed in the office of bookkeeper and chief clerk to the Victoria Colliery Company, in whose service he acquired a knowledge of coal and coal-mining which through life proved very helpful to him. One of the customers of the Company was the Barnsley Gas Company. In those days, the qualifications required in a gas manager were not so varied and important as they are now; and when a vacancy occurred in the management of the gas-works, through the resignation of the then Manager and Secretary—Mr. Joseph Fox—Mr. Hutchinson, although his knowledge of the processes connected with gas manufacture was not extensive, succeeded in obtaining the appointment. What he lacked in knowledge when he took office, he was not long in making good by close study, untiring industry, and an observant eye. From that day to this, his name and that of the Barnsley Gas Company have practically been synonymous. Under his careful and skilful management, the works made great strides. Started in 1821 with a share and loan capital combined of £7500, they have now a capital of more than £100,000. His relations with his workpeople were, in the main, of a thoroughly harmonious character—a fact which was strikingly illustrated in the presentation made to him only a few weeks ago, on attaining his 71st birthday. But he was not a man who would be "put upon" by his employees or anybody else; and in the year 1890, he entered upon a struggle of several weeks' duration against what he and the Directors of the Company regarded as practically an attempt on the part of the men to take the management of the works into their own hands. For some time the works were, in a sense, in a state of siege; and the imported men had to receive protection. Feeling that he was in the right, and the men in the wrong, Mr. Hutchinson stuck to his guns, and, in the end, secured the victory; and he did so without putting the townspeople to the inconvenience of a curtailment of their gas supply.

Apart from his connection with the gas-works, Mr. Hutchinson was well known in Barnsley for his interest in all good causes. His musical accomplishments—he was, for one thing, a charming performer on the violin—and his sociability made him a great favourite. In general as in local gas politics, the deceased gentleman played his part. He was one of the founders of the old British Association of Gas Managers, and also of the Manchester District Institution of Gas Engineers, of which he was at one time the President. To both Associations he contributed papers; and he occasionally joined in the discussions. He was a man of few words; but what he said was generally to the point. For some time, in consequence of advancing years, he had not been so regular an attendant at the meetings as formerly.

Mr. Hutchinson died last Tuesday, at his residence, Pontefract Road, Barnsley. The funeral took place on Friday, and was accompanied by many indications of the esteem in which the deceased was held. The Chairman of the Gas Company (Mr. E. G. Lancaster), and most of the Directors, headed the long procession, which included representatives of the various societies in which the deceased took an interest. The members of the gas profession who were present were Mr. J. West, jun. (who attended on behalf of his father), for The Gas Institute; Mr. S. S. Mellor, of Northwich, for Mr. J. Braddock, President of the Manchester District Institution of Gas Engineers; and Messrs. C. A. Craven (Dewsbury), R. Bridge (Doncaster), and J. Niven (Clayton). Several letters of sympathy and regret were received by the family from gas engineers, in various parts of the country, expressing their inability to attend on account of a meeting of the Council of The Gas Institute in London. As a mark of respect, many of the shops along the route of the procession to the Cemetery were closed; and there was a large concourse of people at the place of interment.

Mr. Hutchinson is survived by a large family. One of his sons (Mr. W. W. Hutchinson) has been for between twenty and thirty years associated with his father in the management of the gas-works; and a second son (Mr. Charles Hutchinson) is the head of the firm of Hutchinson Brothers, gas engineers and contractors, of Barnsley.

ON A CERTAIN SLACKNESS OF GAS ENGINEERS.

It is in accordance with the nature of things that the followers and friends of the gas industry should appear to occupy a defensive position with regard to the efforts of the partisans of other lighting industries who have yet to make good their footing in the scheme of civilization. Gas lighting occupies in many respects the same place in the world's material equipment as illuminating oils and candles. It is so far a necessary of life that it has come to be taken for granted; and, regarded from this standpoint, it may be considered as being in no more need of advertisement than the air we breathe or the water we drink. This is doubtless a very comfortable position, and one to which the rivals of the gas industry would gladly be assured of succeeding. But it is by no means impregnable, in the case of any product of manufacture; and the friends of the gas industry in particular cannot be absolved from the responsibility of requiring to strengthen their hold upon the bases of their prosperity. It cannot fail to have been noticed that a large proportion of the work of the Journal consists in exposing and denouncing misrepresentations relating to gas as an illuminant which are continually being put in circulation by popular speakers and writers. The point we wish now to make is the remarkable plenitude of these attacks upon the gas industry, and the paucity of aggressive efforts on the other side. There is a host of men going about the country lecturing, and a strong contingent of writers on the same side; and from this abundant source flows uninterruptedly a stream of depreciatory statements about gas and gas-lamps which keeps us employed in the wearisome and thankless task of contradiction, correction, and denial. But why should this be the only stream of information respecting artificial lighting, and lighting methods, turned into the technical and general press? It is the bare fact that seldom a week passes without bringing us through the post a crop of indignant letters from gas managers and gas directors in different parts of the country calling attention to the misleading statements of Professor This or Mr. That, and conveying the hope that we shall deal with them as they deserve.

This is all very well, so far as it goes; but time and again we are moved to ask why our correspondents do not themselves carry the war into the enemy's country. A vigorous attack is the best defensive operation; yet this is rarely attempted by those who fly to us for help and comfort. The ignorance that prevails in the community with regard to gas matters is often complained of by chairmen of gas companies; and we are occasionally moved to comment upon glaring instances of the same thing in these pages. But there is another side to the picture. It is by no means creditable to the friends and followers of the national industry of gas supply that the public should still, at this time of day, be sunk in ignorance of the capabilities of one of their most useful servants—a servant that has never been properly appreciated, generally made to bear undeserved blame, and yet contains potentialities of usefulness far beyond the power of most people to realize. It is idle to complain of interested persons for abusing gas. To a certain extent this is to be expected of them. The real trouble consists in the fact that the public are unprepared with that superior knowledge of the truth against which partisan statements would be powerless. It is the business of an electrical propagandist to make his voice heard in the land; but is it the rightful part of the gas engineer to remain dumb? Yet the number of vocal defenders of the gas industry is utterly insignificant beside that of the other party.

Such utterances as the series of lectures recently delivered at the Stratford Town Hall by Professor Vivian B. Lewes constitute a splendid means of defence for the gas industry against disparagement. They are all the better for this purpose for being strictly expository, and not in the slightest degree controversial. Avowedly partial public statements about gas are useful in their way and upon occasion; but what is wanted more urgently is the promulgation of reliable information on the general subject of the capabilities of gas, irrespective of the motive of partizanship. Not that this latter is to be despised; but the public need to be interested in things connected with gas, as a branch of useful information, and there is plenty of work here for many lecturers of Professor Lewes's calibre, if they are to be found. As it is, this popular expositor has almost been as a voice crying in the desert; and what a pity it is! Because it is obvious that nobody who has had the advantage of hearing or reading the dispassionately-stated story which Professor Lewes has told the Stratford people about gas is ever likely to give occasion for such complaints as those referred to in the preceding paragraph.

We want—that is, the gas industry wants—the public ear to be filled with facts about gas, which is the only sure way of preventing the entrance into this curious and uncritical organ of fallacies on the same and allied matters. This can be effected not only by means of popular lectures and addresses, but also by papers communicated to the more important scientific and technical societies at one end of the scale, and demonstrations arranged to catch the public eye at the other. At the same time, everything like deliberate misrepresentations of gas and gas apparatus should be dealt with promptly and thoroughly wherever met with. How easily the popular fancy may be caught by something connected with gas supply may be seen by the illustrative example of the penny-in-the-slot meter, which not only opened up a profitable branch of business in gas supply, but has served even better purpose as an advertisement of the unsuspected possibilities of the industry. And what has been done in this way is capable of repetition, only by means and in circumstances appropriate to the particular kind of apparatus.

There can be no question that the high-power and incandescent burners that have come into being during the past few years have been powerfully instrumental in giving gas lighting a fresh and firmer hold upon the public. People are apt to talk as though the marked development of the use of gas for cooking and heating during the same period had saved the industry at a critical juncture. Although we should be sorry to make any observations that could be interpreted as depreciatory of the influence of this undoubtedly beneficial movement, we have never been willing to see in other applications of gas anything approaching an equivalent for its past and actual vogue as an illuminant; and the part played by the new types of burners in arousing a fresh interest in gas lighting at a time when "new lamps for old ones" was a popular cry, has hardly been fairly recognized. Speaking now, from the safe side of the ditch, we are able to acknowledge that the popularity of gas for its principal use during the last momentous decade would in all probability have suffered severe depreciation if the public had been restricted to the old familiar flat-flame and Argand burners. These are still good servants in their degree. But the most cursory observation of the ways of trade shows that there is nothing like a change of pattern for reviving the demand for staple commodities, even if the quality of the article is not essentially altered thereby. The new gas-burners, however, were more than mere novelties, and more than improvements. They revolutionized the relations between gas manufacturers and their customers.

This fact has been admitted in our columns; but not nearly enough has been made of it in the country. To this hour, when people talk about the illuminating power of gas, they refer, if they know anything of the technicalities of the subject, to the indications of the standard test-burners. If they seek to depreciate gas as an illuminant, they refer for choice to the worst burner they can think of. Why is it that gas engineers do not take pains to make consumers think, when they speak of the lighting value of gas, of the performances of the best recuperative and incandescent burners? We had occasion last week to expose a particularly sad aspersion on the character of the latter appliance; but it is astonishing how quietly most of the followers of the gas industry take these things. We are by no means fanatical admirers of the incandescent burner; and many gas-lamps of the recuperative type leave something to be desired. It is indisputable, however, that in these types of gas lighting apparatus the industry has invaluable supporters; and it is the height of fatuity for gas engineers to stand by and allow their rivals in the eyes of the public to sweep these things into the background, and talk as though the worst flat-flame burner was the best means at the consumers' command for burning gas.

The incandescent burner, after all has been said that can be urged against the colour of the light and the fragility of the mantle, remains one of the most interesting of the results of modern science and industry. Like the electric light itself, it at first suffered from latter-day financiers. But this was not the fault of the invention, which has now proved its intrinsic value by triumphing over troubles that must have wrecked a less meritorious device. The incandescent burner is interesting from a scientific point of view, for many reasons. In the first place, it demonstrates the usefulness of those researches into the composition of the material universe which have made the civilized world acquainted with the existence and the qualities of rare earths and metals. It is the commonest of the reproaches levelled by the ignorant and the superficial against men of science, that they concern themselves with inquiries that cannot be shown to be of the slightest utility. "Where is the sense," asks the man in the street, "of devoting time and money to the separation of infinitesimal quantities of elements of matter which are so rare as to be removed from all prospect of coming into general use for anything?" The answer is the incandescent lamp of Dr. Auer von Welsbach, for the making of which are required materials that, so far as we know, have no other commercial use whatever. Nobody could have suspected that a result of the curious operations that led to the identification and separation of two or three new earths would be the cheapening of gaslight all the world over by about two-thirds.

Again, how remarkable it is that it should be more advantageous in practice to employ the heat of an atmospheric gas-flame to heat up to incandescence the material composing the Welsbach mantles, than to burn the gas in what may be called the natural way. We are taught that the luminosity of gas-flames is due to the incandescence of the solid particles of carbon which are liberated in them in the process of combustion in air. But Dr. Auer has discovered that there are certain materials which can be rendered even more brilliantly incandescent than these carbon particles, with less expenditure of fuel than they require in the ordinary way. The balance-sheet of heat expenditure and lighting effect has never been made out for flames treated in this way; but the vista opened for further research in this direction is most tempting. Who knows what descriptions and forms of matter can be most cheaply raised to incandescence; and what is the limit of duty

that is to be expected of gas in this regard? Men talk about "the light of the future;" but nobody can say in what direction this will-o'-the-wisp is to be sought. At any rate, if there is a prospect of profit on the electrical side in following Tesla, the gas interest need not despair of arriving at brighter things by the way taken so successfully by Dr. von Welsbach.

Gas engineers and the technical press are interested in these considerations; but they are unknown to the public, who are nevertheless assiduously crammed with all the fancies and prophecies of gentlemen like Mr. W. H. Preece, until it becomes the prevalent impression that it is only they who have any ideals, or for whom the future contains any promise. There is, of course, a fashion in these matters; and only the other day a writer in a generally sensibly-conducted newspaper was betrayed into disparaging the light of gas as "essentially vulgar"—as though human vices could be attributed to a means of lighting. But this affectation is of a piece with the "preciousness" of a few scientific men who will hardly allow themselves to regard as a "man and a brother" whoever is hardy enough to exhibit himself on a lecture platform as a student of illuminating gas. Gas is a common drudge, it is true; but in this democratic age is the humble worker to be scorned in order that the meretricious and the fashionable shall be exalted? Alphonse Karr set this question at rest by his eloquent expression of thankfulness that it has pleased the Creator to make the best things of the earth also the commonest. Common coal gas is undoubtedly a good thing; and it is the bounden duty of all who know this to do everything in their power to enlighten those around them who may yet be in ignorance of the truth.

Death of Mrs. While.—The death is announced of Mrs. Elizabeth While, wife of Mr. Samuel While, formerly of Stockton-on-Tees. The sad event took place on Friday last, after only three days' illness.

East London Water Company.—At the forthcoming half-yearly meeting of this Company, the Directors will recommend a dividend at the rate of 8 per cent. per annum, less income-tax, on the ordinary stock; leaving £14,047 to go forward.

Death of Mr. H. B. Mackeson.—The death is announced of Mr. H. B. Mackeson, the chief promoter of the Hythe (Kent) Water-Works, at the age of 81. The deceased gentleman was nine times Mayor of Hythe; and through his efforts main drainage works, water-works, railway extensions, canal constructions, and other important undertakings, were carried out in East Kent.

A Satisfactory Year's Work at Rugby.—In the JOURNAL last week, we noticed, among the reports of Provincial Gas Companies, the results of the past twelve months' operations of the Rugby Gas Company, by which, notwithstanding a considerable loss occasioned by the coal strike and a diminished output, a surplus of close upon £1000 was earned, and a dividend of 11 per cent. was paid for the year. We learn that the Directors are so satisfied at these results—achieved, as they were, in the face of difficulties—that they have increased the salary of the Engineer and Manager (Mr. C. Meiklejohn) by £100 per annum, to date from the beginning of the present year.

Mr. C. R. Bellamy on the Science of Gas Combustion.—At the fortnightly meeting of the Liverpool Engineering Society last Tuesday, Mr. C. R. Bellamy, Superintendent of the Gas Department of the Liverpool Corporation, read a paper on "The Progress of the Science of Gas Combustion." Reserving an abstract of the paper till next week, we may mention that Mr. Bellamy referred to the great waste of gas which now goes on owing to the general ignorance of the simple laws governing the combustion of gas; and he emphasized the importance of using governor burners. He dealt in detail with the merits of the various forms of burners at present in use, and showed how much greater is the quantity of light that can be obtained from a given quantity of gas with improved, as compared with inferior types. An interesting discussion followed the paper.

Flame-Dimensions a Test of the Luminosity of Candles.—In the current number of *Nature*, reference is made to the results of some experiments made by Herr P. Glan, and communicated to *Wiedemann's Annalen*, to show that the luminosity of a candle can be calculated direct from the dimensions of its flame. The volumes of the bright portions of various candle-flames were measured by taking the length by means of a scale placed behind the flame, and the breadth at various points by gauging it with calipers or compasses. These bright portions have approximately the shape of cones; each being penetrated from below by a truncated cone, consisting of the dark central portion. The difference between the volumes of the two cones gave the volume of the brilliant portion. Stearine and paraffin candles of various thicknesses, and provided with different wicks, were compared by means of a rod photometer. It was soon found that the height of the flame was not the only factor determining the brightness. A stearine candle of 5·88 centimetres circumference had, on the other hand, a higher luminosity than another 6·49 centimetres in circumference. But a determination of the ratio of the volume to the illuminating power showed that this ratio is very nearly constant; the difference between the actual luminosity and that calculated from its volume never exceeding 3 per cent. In other words, equal volumes of the bright flame of any two candles gave out the same amount of light.

NOTES.

Professor N. J. Lockyer on Gas-Engines.

In the course of an appreciative notice of Mr. Bryan Donkin's book on gas-engines, recently noticed in the JOURNAL (*ante*, p. 278), Professor Norman J. Lockyer informs the readers of *Nature* that the remedy for the waste of heat in gas-engines signalized by the author lies in the better expansion of the heated gases. This with the Crossley engine is difficult; but with Professor Rowden's engine very complete expansion is said to be obtained, and consequently low pressure at the exhaust and a far cooler cylinder. Of course, as Professor Lockyer admits, this end is attained by sacrificing simplicity of design and working parts; but he questions whether it would not be worth while to experiment in this direction, considering the great saving to be obtained by more complete expansion. The possibility of deriving advantage from the compounding of gas-engines has not been overlooked; more than one machine of the kind having been constructed. But difficulties have arisen in connection with the valves; and these have only been partly overcome. The difficulty of making a valve to continually pass hot gases is acknowledged by Professor Lockyer to be enormous. Yet he declares that compounding is evidently the direction in which gas-engine economy is to be found; and success in this regard is only a question of time. Another point of importance in the economy of the gas-engine is accuracy of manufacture. Professor Lockyer wisely observes that an ill-constructed gas-engine is sure to be a constant trouble; and as many of the machines now in the market are bad copies of the Crossley engine without its accuracy and finish, one must be prepared to occasionally hear of failures of this class of motor. Indeed, it may be said that this result has already been manifested in some cases; so that there is only too much reason to fear lest gas-engines should acquire a bad name through the flooding of the market with cheap specimens pretending to embody the Otto principle, but altogether destitute of the excellence of manufacture which alone made the principle workable.

Gas-Lamps as Weather Indicators.

The observation of street gas-lights as weather indicators has already been noticed by meteorologists; and it is generally understood that the varied appearances presented by gas-lamps sufficiently far removed from the spectator to be affected by the condition of the intervening atmosphere are referable to the same causes that have vested the stars with significance as weather signs. Street-lamps have an advantage over the stars in this respect, inasmuch as they are visible when the skies are overcast. On the other hand, there must be more vagueness in definitions of the optical aspects of such near and familiar objects as these lamps under different atmospheric conditions. An ingenious American who writes to a Pittsburgh newspaper on this subject—which he thinks is his own by virtue of first discovery—tries to reduce weather forecasting from the aspects of the street-lamps to an exact system. According to this authority, the light selected for observation must be at a distance of about 100 yards from the spectator. So conditioned, a "clean, bright light with centre bright as silver" means snow. If the snow is to be accompanied by frost, as is generally the case, the circumstance will be indicated by the apparition of a solid "tail" proceeding from the bottom of the light. The longer and thicker this tail, the harder the coming frost. If the tail is not in appearance solid, but is composed of rays closely pressed together, it prognosticates sunshine next day. This latter effect is said to be corroborated by the appearance of a similar appendix to certain stars, which is conclusive. The prognostic for rain is the appearance of "rays out from the sides and bottom of the light," of the colour of a candle-flame. There is a prognostic for haze or fog; but it is not given in intelligible language. If thunder is imminent, the gas-lamps will appear to have a "very small flame, but bright as silver, with the slightest touch of a mauve tone." The prognostic for wind again is unintelligible; but that for heat is a "hazy fur around the light." With these hints to go upon, weather forecasting in towns should be a simple matter, not needing the intervention of the Meteorological Department.

The Rainfall of the United Kingdom.

The abnormal climatic conditions of the British Isles during the past summer had such a marked effect upon the public lighting and water supply industries, that considerably more than a mere [theoretical interest attaches to the paper on "Rainfall Records" recently read by Mr. G. J. Symons, F.R.S., before the Society of Arts. The paper was good in itself; starting as it did with a reference to the work of the late Mr. Bailey Denton, and discussing the suggestions of Mr. Glaisher, which led up to the present organization for collecting statistics of rainfall. Mr. Symons explained the merits of the rainfall gauges at present in use—not a trifling matter, since, as he asserted, a series of defective gauges cost a British municipality the sum of £125,000, inasmuch as they made the apparent rainfall greater than the fact, and entailed the buying off of calculated compensation to millowners upon a wrong basis. It was stated that during 35 years' observation in London by the author, the smallest amount of rainfall for any month was that for February, 1892, when only 0·01 inch of rain fell.

On the other hand, on June 23, 1878, no less than 3½ inches of rain came down in the short period of 1½ hours. As Mr. Symons observed, "the maximum rate at which rain can fall is a very important feature indeed in designing sewerage and drainage works." The Chairman of the meeting (Sir F. Bramwell) remarked, in commenting upon Mr. Symons's records, that the matter of water supply is to a great degree a question of the quantity of rain that can be depended upon in what the late Mr. Hawksley used to describe as the average of three consecutive dry years. Last summer, as in 1887, there were very many important towns which were on the verge of a water famine, than which nothing could be more awful.

COMMUNICATED ARTICLE.

GAS AND THE ELECTRIC LIGHT.

By W. J. Dibdin, F.I.C., F.C.S.

The electric light, like gas light, is an evolution of scientific discovery which has been in active progress during the whole of this century. Essentially produced by the transmission of energy through either chemical or mechanical means, this energy may be derived from a natural force—as, for instance, a waterfall—or by the combustion of a material in the cells of a voltaic battery or fuel in a furnace. The energy being converted into electric current may be used to manifest electric light by passing between carbon points, or by rendering incandescent solid bodies such as carbon, platinum, or iridium, &c. Sir Humphry Davy, in 1810, established the fact that, by means of a battery of 2000 plates connected by wires to charcoal points, a bright spark was emitted on these points being brought into contact; and by withdrawing them to a distance of 4 inches a constant electrical discharge took place—forming a most brilliant arc of light. On closely examining this arc, Davy found that there was a constant transference of particles of carbon from one electrode to the other, and that the light was due to the incandescence of these particles owing to the intense heat to which they were raised by the electric current. But, as Mr. Denny Lane, in his address to The Gas Institute last year, said—

> In the generation of electricity from mechanical force, an enormous advance has been made since the time when, over eighty years ago, this "new planet" first "swam into the ken" of the great philosopher; and what is most remarkable is the fact that this marvellous growth was derived from two small laboratory experiments. First of all Oersted, in 1819, discovered that a magnetic needle suspended on a pointed pivot was deflected if an electric current was passed through a wire in its vicinity, and parallel to it; and thus electricity produced mechanical movement. It seems strange that no one thought of trying the converse—namely, whether moving the magnet mechanically would produce a current in the wire—until 1831, when Faraday made his great discovery that, in a conductor moved into or out of a magnetic field, a momentary current was produced as it crossed what he called the "lines of force." Everything that has been done since then by Siemens, Gramme, Wilde, Wheatstone, Ladd, and others, is but the natural growth of the seed that germinated in the fertile soil of Oersted's and Faraday's intelligence. And what a growth it has been! The telegraph, the electric light and traction, and the transference of power for over 100 miles, conversations carried on between two people separated by 1000 miles, electro-metallurgy, the separation of rare metals from their matrices, and the thousand offices performed by this deft and willing servant of man. When your practical man scoffs at what he calls the toys of science, let him reflect on the momentous issues of these two simple experiments. In the whole history of practical science, nothing is so amazing as the development of dynamo-electric energy.

Naturally, the first development of the electric light was in the form of arc lamps; these being all mere modifications, for the purpose of making the light continuous, of Davy's original carbon points. Among the first of those which, some fourteen years back, began to be used for general illumination, was that of Jablochkoff, who arranged the two carbons parallel to one another, and made use of an alternating current for the purpose of ensuring the equal consumption of the two points. This light was first extensively tried in Paris, and it was the first system publicly used in London, where it was employed for illuminating the Thames Embankment from Westminster to Blackfriars Bridge Subsequently, Brush improved the regulating arc lamp; and he was rapidly followed by many others, whose improved forms of lamps are now so generally adopted. At the time the Thames Embankment experiments were commenced—in 1880—the great difficulty experienced was the distribution of the light, instead of concentrating it at a few points where illumination was intense, leaving large spaces between insufficiently lighted; and many were the suggestions for bringing about this object. The difficulty was speedily met, however, by the introduction of the incandescent lamp. By the simple expedient of raising a carbon filament *in vacuo* to a white heat, by its resistance to the passage of the current, the electric light at once leaped into popular favour, until it has now taken its place as the fashionable illuminant of the day.

Before leaving the arc lamp, it may be interesting to state that the so-called 1000-candle power Jablochkoff "candles" were, in reality, equal to only 460 candles for the naked light, and were reduced to 150 candles by the use of opal globes, or to 265 candles when glass "frosted" globes were employed. Various measurements by the writer of other arc lamps showed a similar reduction from the electricians' estimates of illuminating power. It has always been a matter for regret that the commercial introduction of the electric light, both arc and incandescent, should have been accompanied by such an unnecessary and wanton exaggeration of the truth in this respect; and it is to be sincerely hoped that, in the near future, the advantages of this form of illumination will be heralded in terms as true as the light itself is beautiful.

Before passing on to the subject of relative cost, &c., it will be convenient here to consider the basis upon which the value of the electric current, and consequently of light and power, is fixed. The Board of Trade unit is accepted in this country as the unit for price. This expression indicates the quantity of the current, expressed in ampères, multiplied by the intensity expressed in volts. So that either 1000 ampères × 1 volt, or 1 ampère × 1000 volts, or 100 ampères × 10 volts, &c., represents a flow of electric energy equal to 1000 watts; and this 1000 watts, or 1 kilowatt, acting during one hour, equals one Board of Trade unit. It will therefore be obvious that if we know the quantity (ampères) and intensity (volts) required to yield a given volume of light, we can at once find the total light obtainable per Board of Trade unit, and consequently the cost, provided the price per unit is fixed.

No little controversy has arisen around the relative merits of high-pressure and low-pressure supplies. It is evident that if the intensity, or *voltage*, be increased in proportion to the quantity, or *ampères*, a larger amount of electric energy can be forced through a given sized wire; and much has been made of the presumed advantages of such a system. Unfortunately, however, the advantage in the first cost of cables is counterbalanced by the necessity for employing means to reduce the intensity of the current before it can be used for domestic purposes. The instruments used for this purpose are known as transformers. Another disadvantage of high-pressure supplies is the danger to life by persons coming in contact with the wires, and from the liability, in the case of bad connections, to casualties from overheating and fire. For these reasons, the tendency is decidedly towards continuous current low-pressure installations.

Thus far about the electric light. It will now be advisable to consider, for comparison, the elementary conditions affecting the supply and use of gas. In order to study the question from this point of view, it will be unnecessary to review the history of gas, but to accept its present well-understood position as a commercial undertaking. In order to utilize gaseous matter either as a fuel or as a light-giver, it, like electrical energy, must be conveyed from the point of generation to that where it is to be utilized. Electricity is conveyed by wires or copper bands; gas is pushed through a pipe. If we want to pass more gas through a given sized pipe, we must send it at a greater pressure; but if the pressure cannot be increased, we must use a larger pipe. It will therefore be seen that, in order to obtain more luminous energy, we must use a larger quantity of gas; but that quantity is unavailable unless it has sufficient pressure behind it to cause it to pass through the orifice of the burner, just as the electric current must have sufficient voltage or pressure to enable it to overcome the resistance of the carbon, and so raise it to its light-giving temperature. We may thus consider that, in the transmission of gaseous and electrical energy respectively, the size of pipes and pressure in the first instance may be compared with the carrying capacity of the wires (in ampères) and the pressure of current (in volts).

In considering the quality of the gas, we not alone look at the pressure measured, in inches, by the height of a column of water supported by it, but at its actual composition, in regard to the quantity of light which a given volume of gas is capable of affording when burnt under certain specified conditions. This quality of the gas is known as its illuminating power. Now, what is the equivalent property pertaining to electrical energy? It is the pressure, or voltage; because, although the quantity of current at which it is supplied may be constant, any falling off in the pressure is followed by a far more rapid diminution of the light given by any specified lamp. Thus a 16-candle power lamp was found to give 15·03 candles when the current indicated 99·33 volts, and 0·628 ampères 62·38 watts. When the voltage fell from 99 to 96, the loss in candle power was from 15 to 10·9, or 27·3 per cent., while when it fell to 90, the loss was exactly 50 per cent. But the number of watts (volts and ampères) by which the value of the current to the consumer is estimated did not fall in proportion, but only from 62 to 56½, or about 9 per cent. The great importance of the voltage being kept fully up to the standard point is, indeed, of far more consequence to the consumer than is that of the illuminating power of the gas being equally up to its standard; and wherever an installation of the electric light is introduced, the suppliers should be under most stringent regulations as to the voltage of the supply.

The means by which the energy, either gaseous or electrical, are to be utilized next invite consideration. These are: (1) Burners which may be divided into two classes—viz., ordinary, such as flat-flames, Argands, &c.; and recuperative, such as the Wenham, and others of that type first introduced by Herr F. Siemens. (2) Electric lamps, which may also be divided into two classes—viz., incandescent and arc lamps. For our purposes, we may compare ordinary flat-flame, &c., gas-burners with incandescent lamps, and recuperative burners with arc

lamps. Before making actual comparisons, it will be well to consider the relative merits of each system, and fix the basis upon which it may be taken.

Good Argand burners will, with 16-candle gas, give from 16 to 17½ candles of light under the best conditions. But flat-flame burners, at their best, will not give more than 15 candles of light; while a large number of inferior burners, used under the worst imaginable conditions, will not furnish more than 10 or 11 candles. We may therefore assume that, under normal conditions, in the majority of well-regulated establishments, such as those wherein the electric light is most likely to be adopted, an all-round average of 14 candles per 5 cubic feet of gas per hour of 16-candle gas may be taken as fairly representing the truth. The average luminous energy per reputed 16-candle power incandescent electric lamp is about 13 candles; the watts being 59. Now, as the Board of Trade unit is 1000 watts acting for one hour, we have an exact means of comparing cost. But, in order not to do anything to overstate the case, let it be assumed that the actual average light per 5 cubic feet of gas in ordinary burners is equal to only 13 instead of 14 candles. Then on this basis we have 59 watts giving 13 candles = 1000 watts giving 220 candles per hour. On the other hand, if 5 cubic feet of gas burning during one hour yield 13 candles, 1000 cubic feet will give 2600 candles. If the price of the electric energy per Board of Trade unit is 6d., then the cost of 2600 candles (= 1000 cubic feet of gas) will be 5s. 11d. But here we are making an assumption of a startling character. We have taken the initial, and not the working intensity of the incandescent lamp. Such a lamp, having an initial intensity of 14·8 candles, may, after 100 hours' work, fall to 14 candles; after 250 hours, to 11·5 candles; and after 500 hours, to 10·5 candles, when it will remain practically constant. It may safely be assumed therefore, that the above 13 candles of light for 59 watts will in a few weeks be reduced to 12 candles; and assuming it remained at that, the electric light at 6d. per Board of Trade unit would be equal to gas at 6s. 4d. per 1000 cubic feet.

These figures are put forward so that anyone may be able to twist them about as he pleases, and thus obtain any results of which he may be in search. In like manner, if we desire to compare the cost of the best flat-flame burners, giving the full 14 candles per 5 cubic feet, the electric light will cost 7s. 10d.; if with Argand burners, giving 17 candles, 9s. 4d.; or if with Wenham or Sugg's "Cromartie" burners, giving 7 candles per cubic foot of gas, or 35 candles for 5 cubic feet, it will be 17s. 2d. per 1000 cubic feet of gas—that is, if the incandescent electric lamp can be depended upon to maintain as much as 12 candles with 59 watts, which, as shown above, is very problematical, both on the ground of actual intensity per unit of current, and reduction in voltage of the current supplied, ensuring a proportionate increase in the price charged. If the Board of Trade unit is 8d. instead of 6d., of course the above facts will be still more in favour of gas in that ratio.

In the case of arc lamps, the result is naturally different; but even here the unfortunate mistake of systematically overstating the actual intensity of the electric light has led to great confusion. As already shown, the effective intensity of a so-called 1000-candle power arc lamp may be accepted at no more than 460 candles, or when reduced by the most suitable globes, let it be assumed at 300 candles at the best. This, with a consumption of energy equal to 500 watts, would equal 600 candles per Board of Trade unit; and at 6d. per unit this would indicate a price equal to 2s. 4d. per 1000 cubic feet of gas, as compared with burners giving an average of 14 candles per 5 cubic feet of gas. But we must compare the arc light with the recuperative gas-burner giving 35 candles per 5 cubic feet of gas, or 7000 candles per 1000 cubic feet; in which case the cost of the electric light would be equal to gas at 5s. 9d. per 1000 cubic feet. It is evident, therefore, that what is wanted is a more economical and constant method of employing the arc light, so that the expense of renewing the carbons (not taken into account in the above estimate) and general attention could be abolished. Considerations of a similar character to the above applying equally, and with greater force, to the use of the albocarbon and Welsbach system of using illuminating gas.

In thus stating the bare facts respecting the cost of the two illuminants, it must not be thought that all other considerations are overlooked; for, while it cannot be denied that the foregoing figures are borne out in practice—the replacement of gas by the electric light having, in a large number of cases which have come under personal observation, raised the lighting bill by some two-and-a-half times—the advantages of having the atmosphere unvitiated by products of combustion, and the ready convenience of the new system, are elements not to be passed by. On this point there is a great deal to be said; and while the electricians have much of the argument on their side, the advocates of gas argue that the question of ventilation is one entirely in the hands of the consumer, and that, by the adoption of recuperative burners with ventilating-tubes attached, the problem of comfortable, healthy, most efficient, and economical illumination is effectually solved. Mr. W. H. Preece has said that the "electric light is essentially the poor man's light." Few people will agree with him as to its present position, whatever it may become in future. At the present time it is undoubtedly the light of luxury, except in certain businesses for which its peculiar properties specially adapt it.

Though efforts are being made to utilize the electric current for purposes of domestic heating, there can be little question that in this respect it must indeed be the heat of luxury for some time to come. Heating by gas is an accomplished fact, but heating by electricity is yet in its infancy; and even when it grows in years, it is a question as to how many would prefer to cook by a heat-source which in cold weather would fail to warm the cook as well as the cooked.

In considering the merits of a scheme for introducing the electric light into small towns, the initial difficulty of inducing residents to incur the expense of wiring their houses must not be overlooked; and no project should be taken in hand until this point is fairly faced. When the electric light first began to find its way as a public illuminant, many persons expressed some fear lest the peculiar character of its rays might be injurious to the eyesight of those constantly at work by its aid. Careful inquiries on the point have elicited the fact that there is no evidence of injury from this cause. Another point was also debated with no little force—viz., the relative diffusive power of the rival illuminants. This, however, like many other objections, seems to have exhausted itself in the heat of debate; and the superior power of the arc light has enabled it to hold its own in competition with all others for outdoor illumination in this respect.

The most interesting feature of the electric light is the property of enabling a light to be readily obtained which is comparable to daylight in character, and therefore especially valuable when it is desired to differentiate colours. Whether or not the time will come when the intensity of the incandescent lamp can be readily varied under normal conditions of current, must be an open question; but undoubtedly it would be of immense advantage if it were possible to raise the temperature of the filament for temporary purposes, until it gave that quality of light which we know it is capable of doing under favourable circumstances—viz., affording a light sufficiently pure for distinguishing colours.

The character of the light obtained from the arc as well as the incandescent lamp has been made the subject of very extensive study, especially by Professor Nicholls, of the Physical Laboratory of the Cornell University, in America, who has published several papers upon the question, following the original work in this direction by Otto Schumann, and others. In the course of these researches, it was demonstrated that the efficiency, or ratio of the energy of the luminous radiation, of the arc lamp to that of the total radiation, luminous and non-luminous, in the horizontal plane, was found to be exceedingly small—varying from about 5 per cent. to a little less than 15 per cent., and the ratio increasing as the diameter of the carbons decreased. In the case of the incandescent lamp at the normal temperature of incandescence, where the intensity lies in the neighbourhood of 16 candles, the efficiency does not rise above 5 or 6 per cent. Continuing, Professor Nicholls says: "Since the ratio of total radiation to light-giving radiation increases but slowly as the temperature of the radiating body rises, the efficiency is not likely to be increased in any very marked degree until we shall have learned how to suppress altogether those long waves which yield us dark heat, and are able to limit the vibrations of our source of light to that brief octave which comprises the wave-lengths to which alone the human retina responds. Whether this great step is to be made by robbing the glowworm and the firefly of their secret, as has been suggested by the Director of the Sibley College of Mechanical Engineering, or by other means, we know not." Mr. Thurston's remarks to the above effect were as follows: "The second of the greatest inventors is he who will teach us the source of the beautiful soft beaming light of the firefly and glowworm, and will show us how to produce this singular illuminant, and to apply it with success practically and commercially." Mr. Thurston claims that the dynamo-electrical engineer has nearly solved this problem. Doubtless he overlooked the fact that Davy and Faraday were chemists.

With regard to the degree of superiority which the electric light possesses over gas and oil flames in the important matter of heating effect on the surrounding atmosphere, Professor Nicholls states that the latter deliver to the room about 1000 gramme-calories of heat per minute for each candle power of 3·6 gramme calories of luminous radiation. An incandescent lamp of 5 per cent. net efficiency delivers only 72 gramme-calories per candle power. Mr. Merritt, of the Cornell University, concludes, from experiments made by Dr. Thomson some 20 years ago, and since repeated by himself, that the true efficiency of an oil-lamp as a light-making machine is only about 0·3 per cent., or one-tenth of that of an incandescent lamp; and that the latter, though an immense improvement upon gas and oil lamps, is still far from being perfect in this respect. Doubtless, as he says, this is a question which merits the serious attention of investigators. In all these comparisons, carried out with so much care, the investigators have worked with the normal or ordinary gas-flames. It yet remains to follow the work with the various improved forms of gas-burners, such as those of the recuperative and incandescent type.

The by no means unimportant question of the relative spectra of the two illuminants under discussion has yet to be considered. Up to the present time, the work in this direction has been confined to the ordinary Argand burner, as already mentioned, so far as gas is concerned; and therefore the conclusions are by no means to be accepted as bearing upon the most recent

improvements in gas consumption. However this may be, we may here consider them as they stand. Again we have to refer to the work of Dr. Julius Thomsen, Professor Nicholls, and others. In the first place, it was found that the light of the candle and of oil and gas flames, although subject to considerable fluctuations from variations of the conditions under which combustion occurs, differ but slightly in quality from each other and from that of incandescent electric lamps maintained at normal candle power. The incandescent material in all is carbon; and it is a significant fact that the average temperature of incandescence is nearly the same in all luminous flames, and that the highest temperature—at any rate until very recently—at which it has been found practicable to maintain the carbon filament of the glow lamp, is very nearly that at which the same material exists under most circumstances in oil and gas flames. Passing to other sources of illumination, such as the lime-light and the electric arc, we find the entire portion of the spectrum lying beyond the yellow increasing more rapidly—regions of longer wave-length than the yellow increasing less rapidly than the candle power, and the rate of increase growing steadily as the wave-length diminishes from the red to the violet end of the spectrum.

Luminosity is the factor which we must take into account in seeking a complete expression for the efficiency of any source of illumination; and the method to be pursued in the determination of the luminosity must depend upon the use to which the light is to be applied. If we estimate light by its power of bringing out the colours of natural objects, the value which we place upon the blue and violet rays must be very different from that which would be ascribed to them if we consider merely its power of illumination as applied to black and white. In a picture-gallery, for instance, or upon the stage, the value of an illuminant increases with the temperature of the incandescent material, out of all proportion to the candle power; whereas candle power affords an excellent measure of the light to be used in a reading-room.

The luminosity of the blue and violet rays is so very small that, in the production of candle power, the influence of the very rapid growth of this end of the spectrum with increasing temperature of the lamp is scarcely appreciable. If we estimate the light-giving value of the different portions of the spectrum by means of the facility with which we can distinguish black characters upon a white ground, the importance of the more refrangible rays is still further diminished. Thus Macé de Lepinay and Nicati have shown that, if yellow and blue light, estimated to be of equal brightness by photometric means, are of such intensity that one can clearly distinguish a printed page when illuminated by the yellow, the same page will be entirely illegible when the blue light alone falls upon it. These observers conclude, indeed, that "the mere distinguishing of objects is due almost exclusively to the illumination produced by the less refrangible half of the normal spectrum." So that at equal brilliancy "the superiority of yellow sources of light (luminous gas-flames, incandescent lamps, &c.) over sources richer in blue rays (such as the light of the electric arc) is incontestable." "The only real advantage," they add, "upon the side of the light from the electric arc is when one desires to rehabilitate objects more nearly in the hues which they present in the light of day." This single advantage is one which it is impossible to take due account of numerically in an estimate of the efficiency of artificial illumination. It is nevertheless a most important factor in determining the adaptability of a light to nearly all the purposes of every-day life.

In the course of a discussion before the American Institute of Electrical Engineers, Professor Nicholls pointed out that if we have three incandescent lamps of different sizes, but each subjected to such a current as is required to give 16 candles by the photometer—the larger lamp having the smallest current, and the smallest lamp the greatest current—they would vary in total luminous energy and in total light-giving value as measured by their luminosity. The smaller lamp with the strongest current would be very much weaker in the red rays; and the blue would be correspondingly much stronger. If we know the state of incandescence and the temperature of the radiating surface, we have a complete definition of the performance of a lamp; and we can then express exactly what it will do for any purpose for which it is designed. If we want colours, we use it at a high incandescence. If we want the greatest possible reading power, we shall get a maximum for that purpose at a lower temperature.

The Directorate of the Kent Water Company.—With reference to the statement made in the JOURNAL last week as to the new Secretary for India (the Right Hon. H. H. Fowler) being a Director of the Kent Water Company, we learn that this is not the case; he having resigned his position upon the Board some eighteen months ago.

Institute of Chemistry.—At the recent eighth annual meeting of this Institute, Dr. W. J. Russell, F.R.S., of St. Bartholomew's Hospital, was elected President in succession to Dr. W. A. Tilden, F.R.S. Notwithstanding the loss of 8 members by death and 14 from other causes last year, there was an increase of 19 in the total; and 98 students were admitted. The roll of membership now stands as follows: Fellows, 738; Associates, 109; Students, 207.

TECHNICAL RECORD.

UNDERGROUND MAINS.

Two papers on the subject of the various systems of underground electric light mains, and the methods of laying them, were read on Monday last week, at a meeting of the Northern Society of Electrical Engineers, held in the Palatine Hote Manchester.

Mr. S. V. Clirehugh, the reader of the first paper, discussed the merits and demerits of insulated cables in conduits, armoured cables, and bare copper in culverts. He expressed the opinion that the last-mentioned system combined most of the essential qualities in any system of mains; these qualities being cheapness, long life, facility for increasing the sectional area of copper without disturbing the surface of the ground, and facility for fault-finding, repairing, inspection, jointing, &c. But there were several objections to it. Firstly, in many large cities it was impossible to find room for this class of conduit, and then recourse was had to insulated cables. Secondly, a water-main bursting might possibly cause a stoppage of the supply. This, however, was not very likely to happen. Thirdly, gas was apt to accumulate in the conduits, giving rise to explosions; but it was less likely to get into a water-tight conduit than into a system of iron pipes where there was no attempt made to keep out the water. Whether bare conductors were more likely to ignite the gas was a much-debated question. Only recently two of the technical papers had articles on the subject. One said it was easy to see how the gas got into the conduits, but not easy to see what fired it. The other wondered how the gas got in, but understood how, once in, it was fired. Personally he was inclined to believe that most explosions occurred from lighted matches, candles, &c., being introduced into the boxes. As regards the life of the culvert system, it seemed that we had at least got hold of materials which had stood the test of time—viz., oak, concrete, and copper.

Mr. John H. Rider, the author of the second paper, also discussed the different systems. He pointed out various advantages of a combination of the "drawn-in" system for feeders and the "built-in" system for the distributing-mains; but he incidentally observed that, judging from certain recent experiences, considerable difficulty in connection with the "drawn-in" system was the danger from gas explosions. There could be little doubt, he said, that the gas came from leaky or broken gas-pipes in the vicinity of the conduit. It was useless to look to the gas companies to lay their mains so that leakage would become impossible. An unlooked-for subsidence of the soil might cause a drawn joint or a broken pipe; and it then only required a spark to complete the mischief. Thorough ventilation of all electric pipes, conduits, and manholes, together with great care in laying and subsequent inspection, seemed the only way to minimize the risks. The perfect freedom of an armoured cable system, laid direct in the ground, from such accidents, was without doubt a very strong point in its favour. He added that a properly constructed and properly ventilated subway system under the streets, would much simplify the question of laying electric mains. But the dangers arising from gas and water pipes bursting, to say nothing of the enormous cost, stood in the way of the adoption of this idea.

The reading of the papers was followed by a discussion.

WATER GAS FOR HEATING AND LIGHTING.

At last year's Meeting of the Chemico-Physical Society in Vienna, Dr. H. STRACHE, of that city, read a paper on the above subject. It appeared in two of the early numbers of the current volume of the *Journal für Gasbeleuchtung*, from which the following abstract translation has been made.

For lighting purposes, the pine-wood torch of early times soon gave place to tallow and wax candles and simple oil-lamps; and these, in turn, to stearine and paraffin candles and mineral oil-lamps, which have now largely given place to coal gas, the electric light (arc and incandescent), and lastly to the Auer, or Welsbach light. The progress towards the use of gaseous fuel for heating purposes is not so marked—in fact, until quite recent years, coke might be regarded as the only artificially produced fuel at all generally employed. Now, though gaseous fuel is largely adopted for industrial purposes, most households are still content to use solid fuel, at a sacrifice of 90 per cent. of its heating value, and an expenditure of much labour. Some few have, however, found the advantages of gaseous fuel so great as to compensate for the enhanced cost which its use entails where coal gas only is available.

It is generally admitted that light is emitted by a flame when solid particles in it are raised to a temperature at which they glow; and whether the solid particles are produced in the flame itself or are introduced into it, constitutes the difference between the ordinary gas-flame and the incandescent light. It is evident that the gas must have sufficient heating power to cause the solid material to glow; and, possessed of this *desideratum*, a gas will, broadly speaking, yield light in proportion to the emitting power of the material. If such material, when heated, can be

introduced artificially into a flame, the only property required of the gas is a sufficiently high heating power; and consequently a gas manufactured for its heating value solely should also prove to be the best medium for providing illumination as well as heat. The lime-light and the Auer burner are well-known instances of the feasibility of producing light from gas by virtue of its heating power being used to raise solid material to incandescence; so we may at once turn to the consideration of the cost and heating value of different kinds of gas.

Producer gas has had the widest application to technical purposes. Its formation by the action of air blown through incandescent carbon is accompanied by a considerable generation of heat, which causes the gas to leave the generator at a high temperature. If it is cooled, by storeage or conveyance to a distance, before it is consumed, this heat is lost. Hence producer gas can only be employed economically close to its place of production. Theoretically, it should consist of two volumes of carbonic oxide and four volumes of nitrogen; and a cubic metre should yield 1018 calories on combustion. Practically, however, it always contains carbonic acid and small quantities of other gases; and a cubic metre may be expected to yield only 700 calories. The flame temperature of producer gas, as ordinarily made, is 1200° C.

If carbonic acid is passed into the producer in regulated quantity, it is reduced, with absorption of heat, to carbonic oxide, the volume of which in the resultant gas is greater than in ordinary producer gas; while a considerable portion of the heat carried away by the latter gas is utilized in effecting the reduction. This carbonic acid producer gas should, theoretically, consist of 40·5 per cent. of carbonic oxide and 59·5 per cent. of nitrogen, and should yield 1235 calories per cubic metre, and give a flame temperature of 1530° C. If steam is introduced along with the air in regulated proportion into the producer, it is decomposed with absorption of heat, with the production of hydrogen and carbonic oxide. The resultant gas (known as Dowson gas), leaving the producer at a temperature of 800° C., should have, theoretically, the following composition: Carbonic oxide, 36·5 per cent.; hydrogen, 9·2 per cent.; nitrogen, 54·3 per cent. Its heating value should be 1350 calories per cubic metre. Practically, the proportion of carbonic oxide is lower, and that of hydrogen higher; while carbonic acid is also present. Nevertheless, the gas has, in practice, a heating value of 1340 calories per cubic metre. The flame temperature should be 1560° C.

All the gases considered up to the present are, however, of comparatively small heating value, and are suitable for use only on the place of production. The formation of producer gas with liberation of heat, and the decomposition of steam with absorption of heat, may be carried out concurrently, as in the manufacture of Dowson gas, but with separation of the products of the two processes. This may be effected either by conducting them in separate chambers, or intermittently in the same chamber. The first method, in which a retort containing carbon is heated externally by gas from a producer, and steam is passed in for decomposition by the heated carbon, is not practically a success, owing to loss of heat in its passage through the walls of the retort. In the second, we have the ordinary method for the production of water gas. The fuel in a tall generator is raised to incandescence by an air-blast passing upwards through it; the producer gas formed being led away from the top. The blast is then stopped and the outlet closed, when steam is admitted at the top. This decomposes in passing down through the hot fuel, with formation of water gas, which escapes through an opening for the purpose at the bottom of the generator.

Theoretically, water gas should consist of equal volumes of carbonic oxide and hydrogen, should yield on combustion 2815 calories per cubic metre, and have a flame temperature of 1875° C. Its formation is accompanied by the absorption of heat, and consequent reduction of the temperature of the fuel. Hence the necessity for arresting the manufacture at frequent intervals to raise the temperature of the fuel by the air-blast and the production of producer gas. In practice, however, water gas contains about 5 per cent. each of nitrogen and carbonic acid, and hence has a heating value of about 2500 calories only per cubic metre. A kilogramme of coke is reckoned to yield 1 cubic metre of water gas and 4 cubic metres of producer gas (or 1 lb. of coke yields 16 cubic feet of water gas and 64 cubic feet of producer gas). The heating value of the fuel is distributed as follows: 33·2 per cent. in the water gas, 51·6 per cent. in the cold producer gas, and 15·2 per cent. loss by cooling of the hot gases. Thus, though only 33 per cent. of the value of the coke is in the water gas, the latter is of high heating power, and is capable of transport without loss in value. The question has to be faced, however, as to what use we can put the large quantity of generator gas formed in restoring the temperature of the fuel-bed. It does not pay to lead it to a distance, and only in a few instances can it be applied to metallurgical purposes on the spot. It may be burnt in chambers packed with a fire-brick, through which the steam and air for the blast can be afterwards led, and thus most of the heat carried back to the generator; but this entails a somewhat complicated and expensive set of apparatus. Or it may be applied, as in America, to the heating of vessels afterwards used for the gasification of carburetting materials.

The impurities in water gas are carbonic acid, nitrogen, oxygen, small quantities of sulphuretted hydrogen and carbon bisulphide, and distinct traces of hydrogen cyanide, silicon hydride, and iron carbonyl. The carbonic acid is due to imperfect reduction, either by reason of too low temperature or an insufficiently thick layer of fuel in the generator. Small quantities do not greatly affect the heating value of the gas; consequently it remains in it, where its removal by lime would be costly. The nitrogen comes from the air left in the interstices of the fuel, and in the free space in the generator, when the blast is shut off. Its presence may be avoided by blowing off the first portions of water gas made at each operation. The sulphur compounds are formed from the sulphur in the coke. The sulphuretted hydrogen may be removed by means of hydrated ferric oxide—preferably the natural bog ore. The amount of carbon bisulphide is quite inconsiderable. Hydrogen cyanide is present in very small amount; but it may be removed, together with solid particles of matter mechanically carried over in the gas, by water in an ordinary coke scrubber. Silicon hydride is readily decomposed, especially if oxygen is present in the gas, and by its decomposition causes a deposit of silica in the exit-pipes or the holder; but it can hardly remain a permanent constituent of the gas. The presence in, and removal of iron carbonyl from water gas will be reverted to later.

Carburetted water gas, which is manufactured so extensively in North America, is favoured by the conditions prevailing there. A good gas coal is wanting; while anthracite and petroleum residues are available in enormous quantities. But in Austria even a correspondingly cheap fuel cannot be had; and the price of petroleum would be prohibitive, even were the duty on it removed. Consequently the manufacture of carburetted water gas need not be considered here.

Water gas possesses all the advantages of a gaseous fuel in common with coal gas; but it has not the disadvantage of the high price of the latter. A cubic metre of water gas develops 2500 calories; the same volume of coal gas, about 5000 calories. Under Vienna conditions, the cost per 1000 calories would be 0·29d. for water gas, and 0·46d. for coal gas; while coal used in a cockle stove may be taken at 0·27d. for the same quantity of heat available for warming a room. For cooking purposes, 1000 available calories cost with water gas 0·58d.; with coal fire, 0·72d. Water gas therefore shows a saving of 20 per cent. With coal gas the cost in Vienna would be 0·91d.

The economy of water gas for heating purposes being proved, the question arises whether it can be made available for use in lighting, since the installation of a separate set of mains and services would be inconvenient and expensive. As carburetting is too costly, we have only the alternative of incandescent lighting. The incandescent burners at present in use have the fault of losing in illuminating power in a short time, and consequently require somewhat frequent renewal. This defect the author believes he has remedied. The early incandescent burners were composed of platinum gauze; then came the Fahnejelm comb, consisting of thin rods of magnesia on an iron support. The light-emitting power of the comb has been improved by impregnating the magnesia with chromic oxide. It is raised to incandescence by a fish-tail burner beneath it. For the Auer light, a rose burner answers best with water gas; but the ordinary mantles in use for coal gas disintegrate rather rapidly when used under the greater pressure at which water gas must be burnt. One has, however, now been found which gives a good light with water gas, and is also durable. The mantles are at present costly; but they may shortly be expected to become considerably cheaper. A modification of the lime-light by Dr. Koch, in which the lime is abandoned for zirconia, may be used with water gas replacing hydrogen, and gives a high lighting efficiency.

All these incandescent burners show a marked deterioration in lighting power after being some hours in operation with water gas; the Auer mantles, which retain their efficiency the longest, requiring replacing after 200 hours' use. This rapid deterioration is due to the deposition of a film of oxide of iron on the surface of the mantle. It has been proved that this deposition of oxide is due to the presence in water gas of iron carbonyl—$Fe(CO)_4$—the compound discovered a few years since by Mond. It remains to be settled at what stage of the process of water gas manufacture this compound is formed; but it is certainly not in the generator. Mond ascertained that the most favourable temperature for its formation was from 50° to 100° C., which would be found at the outlet-pipes and valves of the generator and in the scrubber. It appears, however, from recent experiments, that its formation may occur at the ordinary temperature; and it is an observed fact that the quantity present is greater in gas from an old installation than in that from a new one—pointing to the corrosion of the pipes which occurs during use being an aid to its production. If the source of the iron in the compound be the metal of the pipes, its formation could be prevented by coating the interior of the latter with some inactive material. But the present state of our knowledge does not altogether preclude the opinion that the iron carbonyl may be derived from the iron in the coke.

It is therefore satisfactory to have discovered a method of removing the iron compound from the gas. Heating the gas to the temperature of decomposition of the carbonyl appeared impracticable; but it was found that concentrated sulphuric acid completely and rapidly absorbed the iron compound from the gas. A small cylindrical revolving scrubber was constructed of lead, with lead baffle-plates within, and used, when half

filled with strong sulphuric acid, to purify the water gas. About 3500 cubic feet of gas were purified by from 2 lbs. to 3 lbs. of sulphuric acid; and the waste diluted acid was not valueless. The water gas so purified did not produce a deposit on burning; and an Auer mantle was found to last upwards of 400 hours without appreciable diminution in its power of emitting light. Hence they may reasonably be expected to have a life of 1000 hours. The passage through the sulphuric acid appeared to have increased the efficiency of the gas. With this preliminary purification, therefore, water gas seems well fitted for use in an incandescent system of lighting. A comparison of the cost of 1000 candles per hour under different systems and Vienna conditions shows that the Auer burner with water gas is the cheapest; the Fahnejelm comb giving twice, the Auer burner with coal gas three times, the Auer burner with oil gas five times, and the Argand burner with coal gas twelve times the cost (for the same development of light) of the Auer burner with water gas. The latter gives 1000 candles per hour at a cost of a little less than 2d. Therefore, in addition to being a cheap gas for cooking, heating, and motor purposes, water gas is by far the cheapest illuminant under the conditions prevailing in Vienna.

It may be well to briefly consider some of the objections commonly urged against the use of water gas. It is stated that, as its heating power is only half that of coal gas, volume for volume, the main would be required of double the capacity. But water gas is not affected by pressure, and could safely be sent through the services at a pressure considerably greater than that used in the case of coal gas. Its rate of diffusion is not higher than that of coal gas. The chief objection, however, raised against water gas is its large content of the extremely poisonous carbonic oxide; but as the gas is extensively used in America without more fatal results ensuing than with coal gas, this objection can hardly be considered of great weight. It is, moreover, easy to impart to the gas a very distinct odour by passing it over mercaptan or thioacetone, so that its detection by smell is rendered easy. On the other hand, 18 per cent. of water gas is required to form an explosive mixture with air; whereas 10 per cent. of coal gas in air renders it explosive. It is evident, from the particulars given above, that water gas has an important *rôle* to play in the future of the lighting and heating industries.

The Forthcoming Congress of Hygiene and Demography.—The preliminary arrangements for the seventh International Congress of Hygiene and Demography, to be held at Buda Pesth from the 1st to the 9th of September, are well advanced—as many as 440 papers having, it is stated, already been promised. Most of these treat of hygienic subjects; but 78 are devoted to demography. The congress will be opened by the Archduke Karl Ludwig.

The Proposed State Inspection of Water-Meters in Massachusetts.—We learn from the *Engineering Record* that the Bill introduced into the Massachusetts House of Representatives for the appointment of a State Inspector of Water-Meters, as mentioned in the JOURNAL last week, met with a great deal of disapproval at the meeting of the New England Water-Works Association in Boston on the 24th ult. Our contemporary regards the action of the Association as commendable, and the proposal as "nonsensical."

Pile Driving.—At the meeting of the Society of Engineers on Monday, the 5th inst., Mr. Henry O'Connor, of Beckton, read a paper on "Pile Driving." The author commenced by making a few remarks on the difference in the formulæ suggested by various engineers for calculating the weight required to sink a pile farther into the ground; and he then exhibited a diagram giving the result of these calculations for two piles. This showed that by one formula only 72 tons would sink the pile farther, whereas by another formula it would take 300 tons. This great difference was accounted for by the various strata of the ground through which the pile was driven, and which, the author said, was not sufficiently allowed for. He showed a system which he had adopted of finding out the resistance of each layer of the ground, and the force required to withdraw a pile. He next alluded to the steam pile-driver; and he then mentioned some experiments he had made on the force of the blow given by a "monkey" falling from different heights. He described the difficulty which had been recently experienced at the Beckton Gas-Works in getting a large number of cast-iron piles to stand a specified test; and he showed various shoes for fitting on the bottoms of the piles, to prevent them sinking through the thin stratum of ballast which was found there. He pointed out the shape which the pile was afterwards made, and which had the desired effect. Having stated what he would consider as a safe load on a wooden pile driven in such strata as that in which a very large number of piles had been driven under his superintendence, he showed a diagram he had prepared, which was the result of an enormous number of calculations, by which the safe load on unsupported cast-iron columns might be easily and rapidly found. In conclusion, he gave some comparative figures as to the cost of driving a wooden pile, a cast-iron pile, and making the smallest workable excavation and concreting it; showing that the cast-iron pile cost about three-and-a-half times as much as the wooden one, while the excavation cost about eight times as much.

REGISTER OF PATENTS.

Gas-Engines.—Davy, D., of Sheffield. No. 3401; Feb. 15, 1893.

The object of this invention is to utilize a considerable portion of the heat resulting from the combustion of the explosive mixture used in the working cylinder of a gas or other internal combustion engine, and which would otherwise be carried off by the water-jacket, so as to obtain more perfect combustion of the exploded charge. For the accomplishment of this object, the patentee proposes to employ a duplex engine, working on the four-cycle principle, the two cylinders whereof are in free communication with one another, at least during the explosion or working stroke—the phases of operation being concurrent and similar, except that in the one cylinder an explosive mixture is employed, and in the other cylinder air alone. The two cylinders inhale their respective charges to the full extent on the outward stroke, and compress them to an equal extent on the inward stroke. Upon the ignition of the charge in one cylinder, explosion occurs in that cylinder only; but, owing to the superior pressure thereby generated in that cylinder, part of the burning charge is projected into the other cylinder, where it mingles with the already compressed charge of air therein contained, and imparts thereto some of the surplus heat which it would otherwise lose to the water-jacket, thereby raising the pressure of the compressed air charge. Thus "the same amount of gas may be made to heat and expand, in the aggregate, twice the maximum proportion of air that it has heretofore been possible to work with." The work performed on the one piston by the explosion of the gaseous mixture, and on the other piston by the heating and expansion of the compressed air, is transmitted by any of the usual means to the crank-shaft of the engine.

Gas-Lamps.—Collinge, J., of Preston. No. 4270; Feb. 27, 1893.

Alluding to his proposal, the patentee says: "The object of this invention is to make a chimney which shall enlarge, brighten, and spread out the flame in a flat direction, so as to concentrate the rays of light in a downward course when oil or gas is the light-giving medium." To make such a chimney, he proposes to place one or more smaller globes or funnels inside a larger one, so as to allow a little cavity between the two outermost globes, and as much space between the bottoms of the two globes as will allow of the necessary fittings for an oil-lamp or gas. By this means, the cavity between the two outermost globes or funnels is made into the draught or chimney; and it is said that this large circular cavity-chimney (on account of its great capacity, form, position, and its large exit) becomes so powerful a draught or chimney, that the supply of cold air to the flame is greatly increased, also the cold air is brought down inside the inner globe or funnel, and escapes to the flame through a hole in the bottom thereof—the good effect of which "large increase of cold air to the flame is evident."

Air-Valve Mechanism for Water-Mains.—Hardingham, G. G. M.; communicated by C. T. Pollit, of Adelaide, South Australia. No. 6783; March 30, 1893.

In carrying out this invention, a cylindrical casing is connected to a vertical branch on (or to a pipe-branch from) the water-main; an opening in the bottom of the casing communicating with the branch or branch-pipe. From a cavity near the opening, two passages, one on each side of the casing, lead to the upper end of the apparatus. The top of the casing is closed by a cover, in which the passages may be continued. On the top of the cover, there is a nozzle, with a swan-neck bend attached, in order to prevent dirt falling in; and the opening through the nozzle is closed by a winged valve. The valve-stem is hollow, and has a small perforation at its upper extremity. A chamber in the interior of the casing contains a float, carrying a spindle, the upper end of which works within the hollow valve-stem. The point of the spindle is adapted to fit against a seat at the end of the hollow stem, so as to prevent the escape of water through the perforation. The sides of the upper end of the spindle are flat; communication being thus afforded between the perforation and the upper end of the chamber, when the extremity of the valve-spindle is not against its seat. The lower end of the spindle works in a guide in the casing. The float is hollow, and has no bottom; but two small openings are made in the bottom of the chamber immediately above the branch.

The action of the apparatus is as follows: When the main is empty, the float, spindle, and valve are in their normal or lowest position; the valve being open. While the main is being charged, air escapes past the valve. After the main is full, water rises in the chamber, and lifts the float and spindle—thus forcing the valve carried by the spindle against the seating of the cover, and thereby preventing the escape of the water. If air accumulates in the chamber, water flows from beneath the float through the openings in the bottom of the chamber, until the float and spindle drop, leaving the valve held against its seating by the pressure from the main. When the float and spindle have fallen, air passes between the hollow stem and the spindle, and escapes through the perforation. Thereupon the water rises in the chamber, lifts the float and spindle, and causes the upper extremity of the spindle to bear against its seating in the hollow stem, and close the perforation. This prevents the escape of water; but while the main is being emptied, the valve opens and admits air, so as to ensure a free outflow for the water.

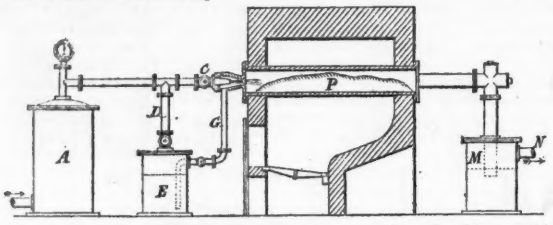
Gas-Stoves.—Doulton, H. L., of Lambeth. No. 7503; April 12, 1893.

In this stove, the gas is introduced into the upper portion, somewhat above the point of combustion. It is carried under a deflector of fire-clay or similar refractory material, by means of one or more pipes, so that it becomes superheated before arriving at the burner-rail or point of combustion. The deflector is suspended above the gas-pipes, and is arranged to radiate a large amount of heat to the floor. It is provided with an overhanging lip, to retain the products of combustion, so as to keep the gas passing through the tubes at a very high temperature. The stove is provided with a highly-glazed reflector below the burners, preferably curved, which, it is said, "secures secondary radiation and reflected heat."

Manufacture of Oil Gas.—Moeller, J., of Westminster. No. 8510; April 27, 1893.

This invention relates to the manufacture of oil gas from ordinary petroleum, shale oil, or any other oil or fatty substance that can be melted by heat.

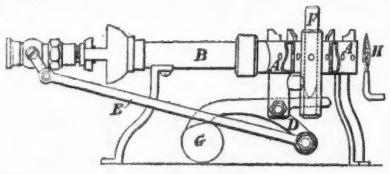
By means of a pump, a vessel is charged to considerable pressure with combustible gas—such as hydrogen, water gas, producer gas, coal gas, or oil gas; also an oil tank or reservoir, with the oil or melted fat to be converted into gas. By means of injector-nozzles, a strong current of gas is made to draw the oil or melted fat from the tank, and discharge it as a spray mixed with gas, and treated in highly heated iron or clay retorts, preferably charged with porous non-combustible refractory material, presenting numerous interstices—such as small blocks of porous clay, with passages and holes through them, or fragments of brick or iron scrap.



A is a vessel charged with combustible gas, and preferably provided with a pressure-gauge. By a branch-pipe D, it communicates with a tank E containing oil. The main-pipe also leads through a cock or valve C to an injector-nozzle; and the tank E, by a pipe G, communicates with the casing surrounding the nozzle F, and having an opening into a retort P. This retort, which is preferably charged with refractory porous material, communicates with a vessel M (containing water to seal the end of the pipe), from the upper part of which a pipe N leads to a gasholder. This retort being heated, compressed gas from A passes by the regulating cock or valve C to the nozzle, whence it issues as a jet, drawing oil from the tank E by the pipe G, and discharging it in finely divided spray mixed with gas into the retort. By partially opening the cock or valve on the pipe D, so as to subject the oil in E to the pressure of the compressed gas, the current of oil to the injector casing may be increased. The oil spray, in passing through the retort mixed with gas, becomes itself converted into gas; and the mixed gases pass to the vessel M and to the gasholder.

Automatically Controlling the Supply of Gas to Stoves.—Ruddock, O. S., of Clapham. No. 22,540; Nov. 24, 1893.

According to this invention, a bell-crank lever is pivoted at a suitable part of the stove, and connected to an arm secured to, or forming part of, the plug of the stopcock. The other end of the lever is adapted to be acted on by the weight of a vessel placed on the stove, so as to maintain the stopcock in its open position. The lever is provided with a counterweight or spring, which, when the vessel is removed from the stove, rotates the lever, and closes or partially closes the stopcock, thereby automatically extinguishing or turning down the gas. When the vessel is replaced on the stove, the weight acting on the lever opens the cock, and the gas is relighted by a pilot light.



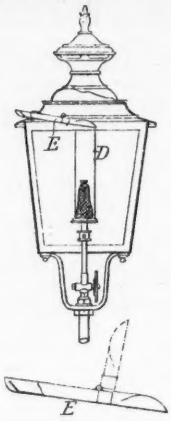
A is the burner; and B, the supply-tube. D is one arm of a bell-crank lever, pivoted on a projecting piece secured to, or forming part of, the burner. This arm is connected by a link E to an arm secured to, or forming part of, the plug of the gas-cock. The second arm of the lever is acted on by a rod F, which slides in a tubular guide, attached to, or forming part of, the burner. G is a weight secured to a third arm of the lever, operating so as to maintain the rod F in its highest position and the cock closed. When the rod F is pressed down by the weight of a vessel placed on the stove, the lever is rotated; and through the link E it rotates the plug of the gas-cock, so as to turn on the gas to be lighted by a pilot light H. The rotation of the lever also lifts the weight G. When the vessel is removed from the stove, the weight acts to rotate the lever to its former position, thereby turning off the gas through the medium of the link E, and restoring the rod F to its highest position.

Gas Motors.—Lindemann, O., of Queen Street, Cheapside, E.C. No. 263; Jan. 4, 1894.

This invention has for its object to more effectually utilize the crank mechanism in four-cycle gas motors, by arranging (behind the cylinder of a motor of this class) a second cylinder lying in the same axis as that of the first, and the piston of which is firmly connected to the piston of the first cylinder. This connection is effected by means of rods outside the first cylinder, or (in a more simple manner) by a piston-rod arranged in the axis, and passing through the end of the first cylinder by means of a stuffing-box. If the charging of the two cylinders is so arranged that their periods of explosion follow each other alternately, work is obtained with each revolution of the crank-shaft—giving about double the output without increasing the size of the crank apparatus. A further advantage is said to be the considerably increased regularity in working, which practically corresponds to a twin motor with coupled cylinders. The charging for both cylinders is effected by a valve-shaft running parallel to the axis of the cylinders; while a governor driven therefrom acts simultaneously on both.

Lighting Gas-Lanterns.—Muchall, C. W., of Wiesbaden, Germany. No. 24,192; Dec. 15, 1893.

This invention refers to a device by means of which lanterns or street-lamps may be lighted, without necessitating the opening of the casing surrounding the burner proper. It consists of a horizontal (or



but very slightly inclined) tube E in the top of the casing of the lantern or street-lamp, provided at its inner end with an enlargement, formed by an inverted spoon or funnel, situated in the space above the burner, or shortly above a chimney proper or a chimney-like part D, adapted to receive as well as conduct the fresh gas issuing from the burner, before the latter has been lighted.

Fuel for Use with Gas-Fires.—Kneller, G. St. J., of Upper Norwood. No. 1029; Jan. 17, 1894.

The claim made for this "invention" is for "novelty in shaping fuel for use with gas-fires;" the patentee specifying that it shall "be shaped to represent artistic figures or forms—such as men, women, children, animal or vegetable life, rural scenes, trees, flowers, or any other artistic designs."

APPLICATIONS FOR LETTERS PATENT.

4615.—Flavell, W., "Preventing the freezing and bursting of water-pipes." March 5.

4661.—MacLaine, A., "Combined manufacture of coal gas and water gas in gas-works, and carburetting the same." March 6.

4688.—Goddard, E., "Wall gas-brackets." March 6.

4700.—Burnett, L. B., "Converting ordinary gas-burners into Bunsen burners." March 6.

4702.—Schonheyder, W. A. G., "Fluid meter applicable as a motor engine." March 6.

4715.—Pemberton, R., "Gas, air, and oil burners." March 6.

4719.—Fleischhauer, E., and Bernstein, M., "Purification of gas." March 6.

4812.—Thompson, W. P., "Obtaining or separating certain gases." March 7.

4830.—Leigh, H. H., "Counter-current air heaters for gas-fired furnaces." A communication from A. Klönne. March 7.

4960.—Singer, P. E., "Double-acting compression gas or oil engines." March 9.

5045.—Martin, J. M., "Hydrocarbon burners." March 10.

Loughborough Gas Company.—The income of this Company during the past year amounted to £11,188; and the expenditure, to £8686—the balance of profit being £2502. It is estimated that the loss caused to the Company by the coal strike was £500. The prescribed dividends of 8 and 7 per cent. have been declared.

The Richmond Well.—At the meeting of the Richmond Town Council last Tuesday, the Water Committee reported on the subject of the well in the Terrace Gardens as follows: "With regard to the adits, the Committee have most carefully considered this matter, and would point out that the supply of water obtained from the adits already driven, though not so large as anticipated, has materially increased since this time last year. As regards the financial aspect, the Borough Accountant reports that the loans raised for the Terrace Gardens well and adits amount together to £14,600, which means an annual cost of £985 10s.; and that the water from the adits, at 156,000 gallons per day for (say) 300 working days in the year, is of the value, at 1s. per 1000 gallons, of £2340 per annum. It will be observed that this calculation is based upon an estimate of 300 working days only; but as it is absolutely essential to work on Sundays—say, an average of 350 days per annum—an additional one-sixth may be added thereto, making the actual value of the water at present obtained from the adits as £2730 per annum. The Committee therefore recommend that application be made to the Local Government Board to sanction a further loan of £1500 for this purpose." Alderman Piggott, in moving the adoption of the report, said the Council would see that the daily increase from the new adit was about 10,500 gallons. Mr. Cockram said that on the 9th of May last the total quantity of water reported to be pumped was 228,000 gallons, while on the 6th of March it was 227,000 gallons. Ten months later they were getting less water; and they were paying £20 a week for wages. He thought it was time they gave up boring under the Thames for water. They had borrowed £100,000 for water supply purposes, and still had a debt of £50,000. He thought it would be much better if they had the water from the Southwark and Vauxhall Company, which would be filtered, and be better for the town. The recommendation was adopted—Mr. Cockram only dissenting.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Estimating the Illuminating Value of Gas by its Calorific Power.

SIR,—I have just read, in the JOURNAL for the 27th ult., the article by Mr. J. T. Sheard, F.C.S., on "A New Method of Valuing Illuminating Gas," in which reference is made to my experiments on the calorific power of gas. Mr. Sheard has applied my formula to calorific powers calculated according to the analysis of the gas; and from the fact that there is not absolute agreement with the corresponding illuminating powers found, he comes to the conclusion that the method is not exact. In operating in this manner, there is an error which must not be neglected for lighting gas, in the composition of which formene predominates. It is known, in fact, according to the experiments of M. Berthelot, that the heat of combustion of a hydrocarbon is never equal to that of its elements. It is not possible, therefore, to compare experiments made under these conditions with results furnished directly by the Berthelot-Mahler calorimetric bomb.

I have continued my experiments, and the relation between illuminating and calorific value has been verified for the gases employed, which were produced by the distillation of Londonderry, West Pelaw Main, and Lambton coals, with the addition of cannel. In all these trials, that which I desired to show clearly—since one must acknowledge that there is a certain relation between the two factors, heat of combustion and lighting power—was that it would be much more simple to abandon, in the sale of gas, the basis of its illuminating value, and to adopt that of its calorific power. At the present time, gas is employed as much for heating as for lighting; and the former method of utilizing it will, it may be safely said, develop more and more. Since we have in our hands an absolutely safe and unimpeachable system of verifying the lighting value of gas by its heating power, I consider I have done well to advise the adoption of that system.

Marseilles, March 8, 1894. P. AGUITTON.

The "Electrician" Articles on Tests of Gas-Burners.

SIR,—I read with some surprise the very unfair criticism, in your "Electric Lighting Memoranda" of Feb. 27, of the articles on "Tests of Gas-Burners," &c. Thinking it was only due to carelessness, I have not taken any notice of it. But I observe in your current issue, on p. 496, that the accusation of deliberate deception is repeated in the words "that the most unsuitable gas-burner had been selected." I challenge you to show that the comparison was made with the most unsuitable burner; and I send you a copy of the article in which the basis of comparison—viz., the average cost of 22 burners—is marked. This basis was *repeated no less than six times*.

In your issue of Feb. 27, it is said that a 2½-watt lamp was selected for comparison. This is utterly untrue; and you will see, in the marked copy which I send you, that this lamp was clearly and explicitly discarded.

This is very unlike your usual criticisms, which I read with interest.

"Electrician" Office, Salisbury Court, E.C., March 14, 1894. A. P. TROTTER, Editor of *The Electrician*.

[We are sorry that our esteemed correspondent should have been annoyed at our criticisms of his articles; but we must "stick to our guns," and repeat that the unfairness of statement is his. It is kind of him to have thought of pardoning us on the score of our opinion of his conclusions having been carelessly formed; but we really do not desire or need so much tenderness. We condemned his style of presenting his final comparison of the costs of lighting by various means, in the form of a table of magnitudes starting with a representation of the effect of burning gas from a burner which we have declared, and repeat, to be most unsuitable for the purpose intended to be served. If also the inclusion in the same table of a 2½-watt lamp with current at 4d. per unit was not intended for the purpose of comparison, what was the good of putting it there? It is true that the different means of lighting noticed by the writer are discussed up and down the last few paragraphs of the articles. But we regarded the concluding diagrammatic representation of the asserted "comparative costs" as the most striking and noteworthy feature of this contribution to the literature of the subject; and if Mr. Trotter will kindly reperuse the last seven lines of the first paragraph of the "Electric Lighting Memoranda" in the JOURNAL for the 27th ult., he will find the "challenge" of his letter met. He says he "clearly and distinctly discarded" the lamps of which we complained; but putting such things into a table sure to catch the eye and confound the judgment of an inexpert reader, is a funny way of discarding them.—ED. J. G. L.]

Sale of Shares.—At the Mart, Tokenhouse Yard, last Wednesday, Messrs. Edwin Fox and Bousfield sold part of an Adventurer's share in the *New River Company*, producing upwards of £2600 per annum, at the rate of £91,800 to £92,160 per share; and part of a King's share, producing £2640 per annum, at the rate of £85,800 to £88,800 per share.

Matlock Bath Gas Company.—The annual general meeting of this Company was held on Monday, the 5th inst., when the Directors presented the accounts, which showed a balance of £1379 on the net revenue account. An interim dividend at the rate of 10 per cent. per annum had been declared for the June half year; and a further payment at the same rate was made for the second half of 1893. The Company (the Manager of which is Mr. A. W. Elton) made satisfactory progress during the past twelve months; and at the close there was a balance of £929 to be carried forward.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The Third Session of the Twenty-fifth Parliament of the United Kingdom opened on Monday last week, when, as customary, the first steps were taken in regard to the Private Bill business of the session. Quite early in the sitting, it was ordered, upon the motion of Sir J. Mowbray, that Mr. H. J. Roby, one of the Deputy-Chairmen, should have leave to seek a conference with the Chairman of Committees of the House of Lords (the Earl of Morley), for the purpose of determining in which House the respective Private Bills should be first considered, and to report thereon to the House. On the following day, Mr. Roby reported that he had conferred with his Lordship as directed, and that they had decided that the following Bills in which our readers are interested should originate in the Upper House:—

Aberdare Local Board Water Bill, Abertillery Local Board (Gas and Water) Bill, Accrington Gas and Water Board Bill, Bacup Corporation Water Bill, Consett Water Bill, Edinburgh and Leith Corporations Gas Bill, Falkirk and District Gas Bill, Falkirk Corporation Gas Bill, Kendal Corporation Gas and Water Bill, Millom Local Board Bill, Newcastle and Gateshead Water Bill, Pontypridd Water (Tramroad) Bill, Swindon Water Bill, and Swinton Local Board Bill.

The following Bills relating to gas and water supply will therefore originate in the House of Commons:—

Alloa Water Bill, Ambleside District Gas and Water Bill, Bury Corporation Bill, Cardiff Corporation Bill, Carshalton and Croydon Gas Bill, Chesterfield Water and Gas Bill, Colne Valley and Central Middlesex Water Companies Bill, Driffield Gas Bill, Dundee Corporation Bill, East London Water Bill, Fulwood Local Board (Water) Bill, Gloucester Corporation Bill, Harrow and Stanmore Gas Bill, Hebden Bridge Gas Bill, London County Council (General Powers) Bill, London County Council (Water) Bill, Neath Corporation Water Bill, Paignton Gas Bill, Plymouth and Stonehouse Gas Bill, Preston Gas Bill, Southend Water Bill, South Hants Water Bill, Southwark and Vauxhall Water Bill, Thames Conservancy Bill, Torquay Gas Bill, and West Middlesex Water Bill.

The petitions for all the Bills in the foregoing lists were reported as having complied with the Standing Orders, with the exception of those for the Cardiff Corporation Bill and the London County Council (Water) Bill; and these were referred to the Select Committee on Standing Orders.

On Thursday the petitions were presented for the following Bills, which were ordered to be brought in:—

Ambleside District Gas and Water Bill, by Sir J. Savory and Captain Bagot.
Bury Corporation Bill, by Sir H. James and Mr. Snape.
Carshalton and Croydon Gas Bill, by Mr. Bonsor and Mr. S. Herbert.
Chesterfield Water and Gas Bill, by Sir T. Roe and Mr. Cavendish.
Colne Valley and Central Middlesex Water Companies Bill, by Mr. W. Ambrose and Mr. Vicary Gibbs.
Driffield Gas Bill, by Mr. Holden, Mr. Dodd, and Mr. C. Wilson.
Dundee Corporation Bill, by Mr. Robertson and Sir J. Leng.
East London Water Bill, by Mr. Banbury, Sir J. Savory, Colonel Lockwood, Sir E. Reed, Mr. Tritton, and Mr. Long.
Fulwood Local Board (Water) Bill, by Sir M. W. Ridley and Mr. Tomlinson.
Gloucester Corporation Bill, by Mr. T. Robinson and Sir W. Wedderburn.
Harrow and Stanmore Gas Bill, by Mr. Ambrose and Mr. Halsey.
Hebden Bridge Gas Bill, by Mr. R. Shaw and Mr. Wayman.
London County Council (General Powers) Bill, by Mr. Boulnois, Mr. Pickersgill, and Mr. J. Stuart.
Neath Corporation Water Bill, by Mr. W. Williams, Mr. S. Evans, and Mr. Burnie.
Paignton Gas Bill, by Mr. Mildmay and Mr. Mallock.
Plymouth and Stonehouse Gas Bill, by Sir E. Clarke and Sir W. Pearce.
Preston Gas Bill, by Mr. Tomlinson and Mr. Hanbury.
Southend Water Bill, by Sir G. Elliot, Mr. Finch, Major Rasch, Dr. Rentoul, and Mr. Usborne.
South Hants Water Bill, by Mr. T. Chamberlayne, Sir F. Evans, Sir F. Fitz-Wygram, and Mr. S. Montagu.
Southwark and Vauxhall Water Bill, by Sir E. Clarke, Sir A. K. Rollit, Sir F. S. Hunt, and Mr. Aird.
Thames Conservancy Bill, by Sir F. Dixon-Hartland and Sir R. Hanson.
Torquay Gas Bill, by Sir J. Kennaway and Mr. Mildmay.
West Middlesex Water Bill, by Sir J. Goldsmid, Sir F. Mappin, and Mr. Boulnois.

On Friday the petition for the Alloa Water Bill was presented, and the Bill was ordered to be brought in by Mr. M'Ewan and Mr. Birrell.

The following progress was subsequently made:—

Bills read the first time and referred to the Examiners: Ambleside District Gas and Water Bill, Carshalton and Croydon Gas Bill, Chesterfield Water and Gas Bill, Colne Valley and Central Middlesex Water Companies Bill, East London Water Bill, Harrow and Stanmore Gas Bill, Hebden Bridge Gas Bill, Paignton Gas Bill, Plymouth and Stonehouse Gas Bill, Preston Gas Bill, Southend Water Bill, South Hants Water Bill, Southwark and Vauxhall Water Bill, Torquay Gas Bill, and West Middlesex Water Bill.

Bills read the first time and ordered for second reading: Bury Corporation Bill, Dundee Corporation Bill, Fulwood Local Board (Water) Bill, Gloucester Corporation Bill, London County Council (General Powers) Bill, Neath Corporation Water Bill, and Thames Conservancy Bill.

The following are among the private members' Bills which have been presented and read the first time:—

Labour Minister Bill, Mines (Eight Hours) Bill, Mining Accidents (Scotland) Bill, Patent Agents Bill, Plumbers' Registration Bill, Railway and Canal Traffic Act (1888) Amendment Bill, Rating of Machinery Bill, Steam Engines and Boilers (Persons in Charge) Bill, and Trade Disputes (Arbitration) Bill.

Petitions against the following Bills have been presented:—

Southwark and Vauxhall Water Bill, from the Hampton Local Board.

Thames Conservancy Bill, from the Hampton Local Board, the Southall Norwood Local Board, the Staines Union Rural Sanitary Authority, the Wallingford Corporation, and the Wilts County Council.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, March 14.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* LOPES *and* DAVEY.)

Holme and King v. The Mayor, &c., of Stockport.

The appeal of the defendants from the order of the Divisional Court, composed of Justices Mathew and Collins, setting aside the judgment of the Official Referee (see *ante*, p. 200), was, after three days' argument allowed to-day, though on a ground not raised in the Court below. The plaintiffs, who are Contractors at Liverpool, had made a gasholder tank for the defendants; and, disputes having arisen, they brought an action, which was referred to the Official Referee, who disallowed the claim for excavating sand and gravel, on the ground that it was an extra, and required a written order from the Engineer.

Mr. GULLY, Q.C., Mr. SMILEY, Q.C., and Mr. BYRNE appeared for the appellants. Mr. MULHOLLAND and Mr. P. MORRIS represented the respondents.

The MASTER of the ROLLS, in giving judgment, said he had no doubt as to the main point in the case, and that was that the Official Referee had for once made a great mistake in the construction of a contract. As he had construed it, the Contractors undertook that this well should be water-tight. He was perfectly certain that this was wrong, and that what the Contractors agreed to was that the work should be well done, according to the plans and specifications, and that they were not to be liable for any defects arising from other causes. Upon the construction put upon the contract by the Referee, it became unnecessary for him to decide any of the other points which were in contest before him for five days; and he did not decide any one of them. But then there was a defect in the plaintiffs' case as to a great part of the claim, although the construction of the contract was in their favour. They were asking for the price of certain work—the digging out of some puddle and putting it back again—and for rendering with cement a part of the inside of the dry well; and the difficulty, to his mind, in which the plaintiffs were—a difficulty which was mentioned to the Referee, but was not urged upon him in the way it should have been—was this: The work for which the plaintiffs desired to charge the Corporation, which he thought was not work they were bound to do under their contract, was either an alteration of, or addition to the contract, or it was done under a new contract. If it was an alteration of the contract by the Engineer (Mr. Jacques), the Contractors were bound to have an order for it in writing; and unless they had it, the Corporation, according to the terms of the contract, were not liable. On the other hand, if it was a new contract, then it was made, in fact, between the Engineer and the plaintiffs; and the question was: Could the new contract, whether in writing or not, bind the Corporation? Only if the plaintiffs showed that the Engineer had authority from the Corporation to make such a new contract; and he could find no such evidence. The only evidence about Mr. Jacques's authority was that he was the Engineer under the contract, not that he had authority to make any other; and an engineer had no right to bind a Corporation, who were his masters, to any contract, unless they had previously given him authority to make such contract. There was no evidence of this; and therefore, on this ground also, the plaintiffs failed, and were not entitled to the two sums which the Divisional Court had found due to them. They thought the Referee had come to the right conclusion, although for a wrong reason; and probably if the right reason had been properly pressed upon his attention, he would have adopted it. As to the question of sand and gravel, he could not bring himself to agree with what he understood was the view taken by his learned brothers; and he would therefore say nothing about it.

Lord Justice LOPES said he thought it was quite clear that the Official Referee had misconstrued the contract in holding that the Contractors guaranteed that the well, when constructed, should be dry. He could find no contract of this kind in the document. All that the Contractors undertook to do was to execute the work indicated with the materials specified, in an efficient and workmanlike manner. It appeared to him, however, that the Divisional Court had gone wrong in directing judgment for the plaintiffs to the extent of £383 7s. in respect of the re-setting of the puddle and the cement on the inside of the well, for the reasons stated by the Master of the Rolls. The work charged for was either within or outside the contract. If it was within it, it was an alteration for which a written order should have been obtained; and if it was a new contract, there was no evidence that the Engineer had authority to make it. He (Lord Justice Lopes) had read through the evidence very carefully, and could find none relating to any contract at all. A corporation could not contract by parole; and there was no resolution, nor anything which at all led to the conclusion that there was any contract by defendants. Then plaintiffs also claimed the large sum of £700 odd, because they said they were compelled to cart certain sand and gravel to some distance; and they had been put to this expense. Their case was that the Corporation undertook that the sand and gravel should be left on the ground, but had afterwards refused to allow it to remain; and therefore the plaintiffs were justified in incurring this expense to get rid of it. He could not find any such contract on the part of the Corporation. He thought the clause relied upon was one inserted for the benefit of the Corporation, entitling them to the sand and gravel not required in the completion of the work; and this was to be placed where the Engineer directed. On one occasion it appeared that the Engineer refused to allow a quantity of sand and gravel, which it was suggested was very much mixed up with other material and rubbish, to be put in a particular place; and thereupon it was carted away. It seemed to him that the plaintiffs' proper course was either to have left it on the ground in some other spot, or, if the Engineer would not allow this, to have communicated with the Corporation and obtained instructions, not to have incurred this large expense quite gratuitously, as it seemed to him. There was an important question as to the liquidated damages. This, however, did not now arise, as it was only claimed as a set-off if the plaintiffs recovered; and they were now held not to be entitled to recover anything.

Lord Justice DAVEY gave judgment to the same effect. He said he was not sure that he agreed with the Divisional Court as to the result of the evidence, remembering that the onus of proof was on the plaintiffs to make out that what they claimed was due to them. The Divisional Court seemed to have thought that the Corporation had failed to show that the failure of these works to keep out the water in one case and keep it in in the other arose from some fault in construction. But, in his opinion, in order to succeed, plaintiffs ought to have shown that it arose from some defect in the design of the works as specified. On the one hand, there was evidence of experts of high position as to the sufficiency of the works as designed; and this seemed to have been met by evidence which was more or less of a speculative or theoretical character. But, in his view, this was immaterial, for the reasons already stated. There was nothing which could be called a written order, or anything like it; nor any evidence of authority being vested in the Engineer to make a new contract. With regard to the charge for carting away the sand and gravel, he agreed with Lord Justice Lopes that there was no ground whatever for the claim, and that the Official Referee was right in refusing it.

The result, therefore, was that the judgment of the Official Referee was restored, and the plaintiffs have to pay the costs.

Mr. MORRIS submitted that a further inquiry ought to take place with regard to one item of £37 10s. which the Official Referee had allowed the defendants on their counterclaim—the plaintiffs not contesting the amount, if they were liable; but this point, as he submitted, had not been decided.

On a suggestion from the Court,

Mr. GULLY said he would give up the item, to save trouble.

Airdrie Iron Company.—The following contracts have recently been obtained by this Company: From the Corporation of Glasgow, for upwards of 200 tons of cast-iron work, in connection with the reconstruction of a retort-house at Dawsholm; from the Cambuslang Gas Company, for a set of four purifiers, each 14 feet square, with valves, connections, and cover-lifting gear; and from the Corporation Gas Commissioners of Hamilton, for a steam-engine and reciprocating gas-exhausters to pass 35,000 cubic feet per hour.

Dorking Gas Company.—The accounts of this Company for the half year to Dec. 31 last show, after providing for the interest on the debenture stock, a balance of £1529 available for dividend; and the payment of dividends at the rate of 9 per cent. on the "A" and "B" shares, and 7 per cent. on the "C" shares is recommended. This will absorb £738, and leave £791 to be carried forward to the next account, as against £560 at the end of the previous six months. This, the Directors remark, is a satisfactory increase; but in the present state of the coal market, they think it unwise to recommend the payment of a higher rate of dividend. Should, however, the contract for the present year's supply of coal be made at favourable prices, they hope to resume the payment of maximum dividends in September next. The Company were able to pass through the late coal strike without serious inconvenience. But the past experience has led the Directors to decide to still further add to their emergency coal stock; and they have instructed the Manager (Mr. S. Carpenter) to act in accordance with their decision.

The Limit of Time for the Recovery of Water-Rates.—At the Thames Police Court on the 3rd inst., Mr. Leonard Charles, of 289, Brixton Road, attended to answer a summons, as owner, for £9 18s., being six quarters' water-rate due to the East London Water Company in respect of houses in Totnes Terrace, Millwall. Mr. R. M. Bray and Mr. George Kebbell appeared for the Company; Mr. S. Saw, jun., represented the defendant. The case was of considerable importance to water companies and the public, because the point was raised by the Magistrate (Mr. Dickinson) whether the six months' limit prescribed by Jervis's Act did not apply to the recovery of water-rates. It was stated by Counsel for the Company that, as regarded houses over the annual value of £20, it was not of so much importance, as the Companies still had the power to cut off water for unpaid rates; but as regarded houses not exceeding the annual value of £20, this power was taken away by Fulton's Act, and practically the Companies could only look to the owners, as in the present case. It was pointed out that if, as frequently happened, a company failed for months, and even years, to discover the owner, and if, when they did so discover him, the company were to be precluded from recovering more than six months' arrears, a serious injustice, and one which was never contemplated by the Legislature, would be inflicted. Mr. Kebbell, in reply to the Magistrate, said until last May the Company only sued in the County Court, and after that time only came to the Police Court in respect of small sums. It was very difficult to recover money through the County Court; and, besides that, the fees were enormous. In some cases they amounted to ten and even twenty times as much as they were in the Police Court. Mr. Bray having addressed the Magistrate at length in support of his contention that the six months' limit did not apply, Mr. Saw argued that it did. Mr. Dickinson said he must take time to consider his decision. This he gave last Saturday. He said he had no doubt the Company could not recover beyond the six months' limit; and so there must be judgment for £2 9s. and 2s. costs. In answer to Mr. Kebbell, he said that, as the question was a very important one, he would willingly state a case.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY'S CHARGE FOR GAS.

It will be in the recollection of our readers that, on the occasion of the last half-yearly meeting of The Gaslight and Coke Company, the Governor (Colonel Makins) alluded to the complaints made by some of the consumers at the difference between the price charged for gas by the Company and that of the South Metropolitan Company; and he explained to the meeting, at some length, the reasons for that difference. At the request of some of the proprietors present, it was arranged that the information then furnished should be printed and circulated among the shareholders. This has now been done; the statement (given below) being preceded by a letter from the Secretary and General Manager (Mr. J. W. Field), in which he says: "Taking the figures of the South Metropolitan Company as the standard, the annexed statement shows the differences between these and the corresponding figures of this Company, and explains why such differences exist. It will be observed that, notwithstanding what has been elsewhere urged to the contrary, these differences are such as would be found to exist under any management; each one of them being the effect of some special condition of the Company's position and district of supply. The reduction in gas sales experienced in 1893 (from which all the Metropolitan Companies suffered more or less), of course tended to bring these differences into prominence; but upon the return of normal weather, with its accompanying increased demand for gas, this Company's price will again, as in past years, be found approaching more nearly that of the neighbouring Companies. The Directors hope that, with this information in their possession, the proprietors will be able to correct such inaccurate statements on this subject as have been made from time to time in the Press and elsewhere."

Statement of the Differences between the Cost of this Company's Working and Capital Charges and those of the South Metropolitan Company.

Charges for Capital.—This Company's charge amounts to 13·82d. per 1000 cubic feet, as against that of the South Metropolitan Company, 11·64d.—a difference of 2·18d. per 1000 cubic feet. The explanation of this is that, while this Company's annual sale of gas is equal to three times that of the South Metropolitan Company, their maximum day's delivery is equal to three-and-a-half times that of the South Metropolitan Company. This has rendered necessary a much larger capital expenditure in providing the plant required to meet the demand for gas than would have been necessary had this Company's maximum delivery borne the same proportion to their total annual make as in the case of the South Metropolitan Company. This larger capital expenditure has amounted approximately, to £1,800,000. Moreover, Parliament required the closing of four of this Company's works in London, and the transfer of their manufacture to the Company's works at Beckton; and this has entailed a special capital expenditure of about £700,000. These two sums equal £2,500,000, and the net interest thereon £172,000, or, per 1000 cubic feet	2·3d.
Wear and Tear.—The cost of wear and tear is necessarily higher per 1000 cubic feet, in consequence of the additional plant which has been provided, as explained above. Calculating this charge (£466,695) on the amount of capital (£10,729,897) actually expended, gives 4·35 per cent. for this Company, as compared with the South Metropolitan Company of 4·53 per cent. But, notwithstanding this lower rate per cent. upon the actual capital expended, the charge per 1000 cubic feet of gas sold is 0·57d. higher than in the case of the South Metropolitan Company	0·6
Rates and Taxes.—The amount required for payment of interest on this Company's capital, for the reasons set out above, being larger in proportion to the quantity of gas sold than in the case of the South Metropolitan Company, and so necessitating a higher price of gas, enables the assessment authorities to place a proportionately higher rateable value upon this Company's undertaking. The extra rates paid by the Company, as compared with the South Metropolitan Company, nearly amount to	1·0
Coal.—The cost of coal is increased in the case of this Company by the heavy lighterage and canal dues upon the quantity sent up to the existing canal stations. Moreover, the South Metropolitan Company obtained the advantages of last year's cheap coal contracts at an earlier date than was the case with this Company. (Seeing, however, that coals are higher now than in the spring of 1893, the advantage of this arrangement will this year be with this Company, as their low-priced contracts will run on for a longer period than will those of the South Metropolitan Company.) The value of these two items is equal to.	1·2
Enrichment of Gas.—After, however, making this allowance (1·2d.), there remains a difference in favour of the South Metropolitan Company of 0·8d. per 1000 cubic feet of gas in the cost of coal, of which certainly one-half is to be attributed to the fact that the gas manufactured at this Company's station at Beckton is far more rigorously tested by the Local Authorities than is the gas of any other Metropolitan Company; there being no less than five separate testing-stations attached to these works, at distances varying from 9 miles to 14 miles from Beckton, whereas the greatest distance between any one of the works of the other Gas Companies in London and the single testing-station attached to it is under 5 miles	0·4
Coke.—At Beckton, where the Company's largest works are situate, there is absolutely no local trade for coke; and the whole quantity made there has to be sold, at comparatively low prices, to cement makers and others. The same remark applies, in a less degree, to the works at Bromley. The loss occasioned by this is	1·0
	6·5d.
This Company had a surplus on the working of the year 1893	0·8
	7·3d.

The actual difference between the prices of gas of the two Companies for the year 1893 was 7·2d. per 1000 cubic feet. It would therefore appear, from the foregoing figures, that, had the conditions of supply of gas by this Company been as favourable as those of the South Metropolitan Company, the price of gas would have been the same in both Companies' districts.

SHEFFIELD UNITED GAS COMPANY.

The Ordinary General Meeting of this Company was held on Monday last week—Sir F. T. MAPPIN, Bart., M.P., in the chair.

The report and statement of accounts for the half year to Dec. 31 having been taken as read (see *ante*, p. 342),

The CHAIRMAN moved their adoption. In the course of his remarks, he said that he had always hitherto been able to congratulate the shareholders upon the successful working of the business; but on this occasion, he was sorry to say that he was neither satisfied himself, nor did he think his colleagues were, at the results attained during the six months. They were, however, not singular in being unfortunate. Most of those companies who had contracted for, or purchased, their coals in the Midland district had suffered more or less in consequence of the coal trade dispute; and the net earnings of the Sheffield Company had been so seriously affected that some of the shareholders might feel they had not the same confidence in the concern as before. This was not the way in which he looked at the matter; and he desired to put before them the exact position of their affairs. They carbonized during the six months 8472 tons of coal less than in the same period of 1892; and they had paid £19,413 more for coals. They received £1239 less for the gas supplied; and had not their receipts been considerably increased by the advance in the price of 3d. per 1000 cubic feet, the result would have been still more serious. All classes of the community felt the deplorable results of the dispute between the miners and their employers. But the Directors, like others, were powerless; and they saw the strike progress from July 28 till Nov. 20—nearly 17 weeks. Such a state of affairs they were not prepared to grapple with. They had, when the stoppage commenced, nearly three months' stock of coal in hand; and they thought that, with what they might be able to obtain from their contractors, there would be little fear of their running short of coal. When their stock became a very small one, they felt they could wait no longer, but must have more coal, no matter what the price, because they were bound to supply the consumers with gas. They, therefore, purchased 10,000 tons, and paid for it £4795 more than the same quantity had cost in 1892. They had then to look seriously at their position, because they found, if the strike went on to the end of the year, they would have a further additional expenditure of £22,000; making something like £27,000 excess over 1892. The Directors had to look to the interests of the shareholders as well as those of the consumers; and he held that, as sensible men, it was their duty to prevent the value of the shareholders, property being reduced in the market by taking an excessive sum from the reserve fund. It was no fault of the Directors that they had to pay these excessive prices. They were bound to supply gas when it was required; and having the power to increase the price when anything unforeseen occurred, they intimated to the consumers that they would charge 3d. per 1000 cubic feet extra for the gas, and he thought the shareholders would sanction this act. Beyond that, they must bear in mind that since June, 1890, they had already withdrawn £24,117 from the reserves of the Company, to make up the dividend on various occasions; and to add another £20,000 to £30,000 to that amount was too serious a step. Their anxiety was also increased somewhat by the apparent falling off in the consumption. Various causes beyond the strike had to do with this; but he scarcely thought that in any half year in the future they could expect such a combination of difficulties as had come upon them during the past six months. A serious aspect connected with the coal trade dispute was undoubtedly the stoppage of works for want of fuel; and another fact bearing upon the falling off in the consumption of gas was the increased temperature both of night and day, and also the wonderful amount of sunshine—all tending to diminish the use of gas to a very large extent. He was not one of those who looked upon the present state of trade in Sheffield as permanent. He believed that Sheffield would go forward in the future as it had done in the past. Possibly its progress would not be so rapid. But there would come upon the Company a demand for increased quantities of gas; and when the time arrived, they must not be like another Company which he could name, which waited until the demand had come upon them, and then found their difficulties arise. During the last six months, the Directors had spent £17,781 on capital account. That was more than double the normal amount of capital expenditure in six months; but the works at Grimesthorpe were going forward, though without any very great pressure being put upon them, and that was the cause of the extra expenditure. The net revenue did not, as the shareholders were aware, enable the Directors to pay the usual dividend; and they had to take £14,723 from the reserve fund—leaving that fund at £60,268, or £25,924 below its maximum. During the period of which he had been speaking, they received less for gas by £1239; and they paid £19,413 more for coals, and received £928 less for coke, having carbonized 8472 tons less coal. The rates and taxes had increased by £626; and their coal-waggons had earned £236 less. These items amounted to a considerable sum, and left them with a much reduced balance. Turning to what he described as the favourable side of the accounts, the Chairman said for the repair and renewal of works they had paid £7792 less, and £1038 less for carbonizing wages; and they received £2703 more for sulphate of ammonia. The monthly decreases in the consumption of gas were rather interesting, and showed, he thought, that the difficulties were caused by events over which the Directors had no control. In July, they had a decrease in the consumption of gas of 2·95 per cent.; in August, of 6·06 per cent.; in September, of 4·88 per cent.; in October (which was the critical time in the coal strike), of 10·93 per cent.; in November, of 8·05 per cent.; and in December, of 7·88 per cent. Altogether the average for the six months was equal to 7·22 per cent.—a reduction of consumption that had never before occurred since he had been connected with the Company. He was glad to say, however,

that so far this year they did not see any signs of such a calamity again occurring. Up to Saturday last, the decrease in the consumption of gas was only 1·59 per cent. for the two and a half months. The average price which they had paid for coals during the six months, much of which was contracted for at low prices, was 15s. 4·5d. per ton, against 10s. 3·88d. in 1892; and at the same time the quality was inferior. They had endeavoured to keep up the quality of the gas they supplied. Up to Sept. 30, they made with the old burner 453 tests, which equalled 17·61 candles; and since that time by the new burner, which they were authorized by their new powers to use, they made 468 tests up to Dec. 31, 1893—the average illuminating power being 17·88 candles. Therefore their illuminating power had been above 17½ candles. During the half year they fixed 442 additional meters; making a total of 50,809 meters in use. The number of gas consumers was 48,956. The cooking-stoves in use numbered 1731; and during the year, 1127 gas-fires had been sold, besides 625 stoves of other descriptions. Although the Company might have competition with the electric light in certain quarters, where people could afford to pay the price for it, yet for heating and other purposes gas would, in his opinion, continue to maintain its position. He noticed that the Parliamentary Committee of the City Council in December last passed a resolution in reference to the letter sent by the Gas Company to the Corporation. The resolution was to this effect: "That the Committee rely upon the promise of the Company in that letter to revert to the former low rates for gas at the first opportunity that circumstances will allow of." This was the first opportunity he had had of endorsing the letter, and of saying that it was the intention of his colleagues and of himself to adhere strictly to the letter; and as soon as circumstances would allow, they would be only too glad to revert to the old prices which they charged for gas. They could not see their way at all clearly to doing it at present. They heard on all sides of combinations of coalowners and others to raise the price of coal to companies like theirs; and until they saw the coal trade more settled than it was at present, they could say no more than was stated in the letter. To the statement in that letter they intended to adhere strictly, and to carry it out honourably.

Mr. E. HALL seconded the motion, which was carried unanimously.

The usual dividend at the rate of 10 per cent. per annum upon the various stocks was declared.

The meeting was then made special for the purpose of authorizing the creation and issue of the sum of £50,000, part of the debenture stock (bearing 4 per cent. interest) the Company are authorized to raise under their recent Act.

The CHAIRMAN in moving the necessary resolution, said it was not the intention of the Directors to issue the whole of the £50,000 at the present time; but they were now taking powers to do so rather than go to the expense and trouble of calling the shareholders together to obtain their sanction at some future time when they required it. They did not yet know when they would issue the first portion; but possibly it might be before the next half-yearly meeting.

Dr. SORBY seconded the motion, and it was agreed to.

A vote of thanks to the Directors concluded the proceedings.

LEICESTER CORPORATION GAS AND WATER DEPARTMENTS

The Half-Yearly Reports.

At a Special Meeting of the Leicester Town Council last Tuesday—the MAYOR (Alderman Israel Hart) presiding—the reports of the Gas and Water Committees for the half year ending on Dec. 31 last were submitted.

The Gas Committee stated that the net profits, after paying interest on the capital, were £12,604. Out of this sum had been paid £3262, the half-year's amount of sinking fund; leaving a balance of £9342, which, added to the net profit (£10,677) for the half year ending June last, would make a total of £20,019 to be applied to the district fund at the close of the current financial year (the 31st inst.), or from which the Council might, were they so minded, increase the present reserve fund of £5000 under the authority of the Provisional Order amending the Gas and Water Transfer Act, 1878, or appropriate, or set aside a sum to be applicable for the renewal of works under the authority of section 17 of the Leicester Corporation Act, 1884. The accounts included the result of the working of the residual products department and the gas-fitting business. The net amount realized by the former was £8529; and with regard to the latter, the half-year's working showed a net profit of £334. The Committee recommended that the total net balance of £20,019 be applied to the district fund, under the provisions of the local Act of 1878. During the six months 47,789 tons of coal were carbonized; and the quantity of gas made was 580,899,000 cubic feet, as against 593,635,000 cubic feet in the corresponding half of the previous year—being a decrease of 12,736,000 cubic feet, or 2·14 per cent. The average illuminating power of the gas was as follows: Belgrave Gate works, 15·95 sperm candles; Aylestone Road works, 16·66 sperm candles; at the Town Offices in Millstone Lane, 16·30 sperm candles.

Alderman LENNARD, in moving the adoption of the report, remarked that there had been a decrease in the consumption of gas amounting to 3½ per cent., which represented a decreased revenue of £2275. It was a serious loss to the department; but there was no cause for alarm—the decrease being due to the phenomenally hot summer through which they had passed, and not to the competition of any other illuminant.

Mr. BILLINGS seconded the motion.

Mr. VINCENT congratulated the Committee upon the result of their labours, notwithstanding the difficulties which had beset them—difficulties which in some towns had done away with the whole of the profits, and in many cases had led to a rise in the price of gas. It was most satisfactory that this course had not been necessary in their own case. The Finance Committee were very glad, and congratulated the Chairman and Committee of the Gas Department on being able to present so successful a statement.

The report was adopted.

The Water Committee reported that the net profit of their undertaking, after paying interest on capital, was £6729. Out of this had been paid the sum of £2114, the half-year's amount of sinking fund; leaving a balance of £4615, which, added to the balance of net profit (£6042) for the half year ending June 30 last, made a total of £10,658. The Committee recommended that £600 be paid to the reserve fund, and that the balance of £10,058 be transferred to the district fund at the close of the current financial year. The quantity of water delivered during the twelve months within the limits of supply was 1,173,882,040 gallons; and the average consumption of water per day per head of the population supplied was 15·84 gallons. This also included the amount supplied for trade purposes. The number of houses on the books at the end of December was 40,607; giving an estimated population of 203,035, which was an increase at the rate of 3·61 per cent. per annum.

This report was also adopted.

IMPROVEMENTS AT THE NOTTINGHAM CORPORATION GAS-WORKS.

Last Tuesday, some important extensions which have been carried out at the Eastcroft gas-works of the Nottingham Corporation were formally inaugurated by the Chairman of the Gas Committee (Alderman Barber, J.P.), who was accompanied by his colleagues, the Town Clerk (Sir S. G. Johnson), the Gas Engineer and Manager (Mr. W. R. Chester), and the Manager of the works (Mr. Blakeley). The company having assembled,

Alderman FORD, addressing Alderman Barber, said the members of the Committee could not allow the present occasion to pass without recognizing in some way the lengthy services of that gentleman in connection with the undertaking. The new extensions had been carried out at great expense, and under considerable engineering difficulties, which had been surmounted with the utmost skill by their Engineer. With reference to Alderman Barber, he had been the Chairman of the Committee for a period of twelve years, during the whole of which time he (the speaker) had filled the position of Vice-Chairman; and they had worked together most harmoniously. Alderman Barber had once thought of retiring on account of ill-health; but he had been persuaded to continue his connection with the Committee, and had taken up the work with renewed vigour, particularly as to the extension of these works, which had now arrived at a satisfactory conclusion. It had been decided to present him with a gold key as a memento of the completion of so large an addition to the undertaking. This had been resolved upon without any previous intimation to the Chairman; and it was to be hoped that Alderman Barber would live long to possess the key as a reminder of that interesting occasion, and that some time would elapse before he found it necessary to resign the Chairmanship of the Committee.

Alderman BARBER heartily thanked the Committee for this additional mark of the respect in which they held him, and for having thought of him in the way they had done. He would, he said, treasure the key as a memento of the harmonious relations between himself and the Committee.

The key, the entire handle of which was of massive gold, bore upon an embossed shield the inscription: "Presented to Alderman John Barber, J.P., Chairman of the Gas Committee, March 1, 1894." On the reverse side was displayed the Corporation arms, surrounded by the words: "Opening of new engine-house, Eastcroft Gas-Works, Nottingham."

Those present then inspected the extensions, under the guidance of Mr. Chester.* They first visited the tar and ammoniacal liquor storeage tanks, which have an area of 91 ft. by 80 ft., and are nearly 16 feet deep from the floor-line; the capacity being equal to 30 days' maximum make—that is, 400,000 gallons. Brick arches, coated with asphalte, cover the tanks at the top; the finishing, to form a floor for purifying material, being fine cement concrete. The floor for the preparation of the purifying material is 91 ft. by 80 ft., and is provided with two lines of rails communicating with turntables—the new purifying material being brought in railway waggons and lifted into the purifiers above by endless chain bucket elevators. The purifiers themselves are placed upon girders 12 feet above the line of the floor; and each purifier holds either 60 tons of oxide or 36 tons of prepared lime. The new purifiers have an area of two and three-quarter times, and a capacity three times, greater than those in use before. The covers of the purifiers—each of them weighing about 13 tons—are lifted by hydraulic "Goliaths." The old purifiers, eight in number, each 15 feet square, had a capacity of 6 tons of lime and 10 tons of oxide each. During the winter four of these purifiers had to be emptied per day; now it is only necessary to discharge one of the new purifiers once in four days. The overhead tanks for water, tar, and ammoniacal liquor are constructed of cast-iron flanged plates bolted together and placed on girders above the boilers. The water-tank is 30½ ft. by 22 ft., and 7 ft. deep, and holds 26,500 gallons, or about 120 tons of water. It is open at the top, and receives the rain water from a considerable portion of the roof. It is supplied by pumps in the engine-room from a well on the works. The water is soft, and good for the general purposes of the works. The tar and liquor tanks, of like capacity, are each 30½ ft. by 17½ ft., and 7 ft. deep, equal to 21,000 gallons, or about 100 tons. They are both covered in, to prevent any obnoxious fumes escaping into the atmosphere, and have sealed manhole covers in the top. The new boiler-house chimney is perhaps the finest specimen of such a structure within the borough—indeed, within a radius of many miles. The foundations of the chimney, which is 105 feet above the ground line, have been carried down 28 feet to the rock. A parallel flue, with an area of 12¼ square feet, communicates with the boiler in such a manner as to give a keen draught. The tar and liquor pump-house, a small place apart from the main building, contains pumps for tar and ammoniacal liquor. The steam-boilers,

* Some interesting particulars as to the growth of the gas supply of Nottingham were given by Mr. Chester on the occasion of the visit of the Manchester District Institution of Gas Engineers to the town in September last year (see JOURNAL for Sept. 5, 1893, p. 447).

and the engine, exhauster, station meter, and governor house—which is 60 ft. by 56 ft.—were next inspected. The house contains two 100,000 feet per hour engines and exhausters, one 60,000 do., two 100,000 feet meters, four governors, one pair of water pumping engines, and one engine and dynamo for electric lighting. The whole of the block of buildings is lighted up, for purposes of safety, by electricity. As far as possible to ensure that there shall be safety, the dynamo is enclosed in a case, through which air is blown from a fan which supplies the blast to the boiler-fires. The consequence is that so long as a pressure of air is kept up in this enclosure, no gaseous explosive mixture can possibly come into contact with the electric sparks from the dynamo. In the new store-room, and mechanics' and gas-fitters' shop, the arrangements are admirable. The whole block of buildings stands on ground 142½ ft. by 95¾ ft. The contract for the builders' work was carried out by Messrs. J. Hodson and Son; the iron-work of roof girders, columns, &c., by Messrs. Ashmore, Benson, Pease, and Co.; the purifiers and overhead tanks, by Messrs. Newton, Chambers, and Co.; the "Goliaths" and elevators, by West's Gas Improvement Company; the boilers, by Messrs. Galloway and Son; the station meters by Messrs. W. Parkinson and Co.; the exhauster and engines, by Messrs. Bryan Donkin and Co.; the station governors, by Messrs. W. and B. Cowan; and the electric lighting plant, by Messrs. Mather and Platt. The approximate cost of the plant was as follows: Building (including underground storeage tanks), £14,000; purifiers, tanks, and connections, £5300; "Goliaths," £800; elevators, shafting, and engine, £600; boilers and setting, and Perrett's furnaces, £2000; station meters, £2300; exhausters, £1100; governors, £500; electric lighting plant, £250; pump-house and new laboratory, £350; connections and fittings, £300—making a total of £27,500.

THE NEW YORK GAS EXAMINER ON STANDARD CANDLES.

The *American Gaslight Journal* for the 5th inst. contains the following article, specially prepared by Professor E. G. Love, Ph.D., the Gas Examiner for New York City, on the subject of "Standard Candles."

It is rather surprising that no effort looking towards more uniformity in the manufacture of standard candles should have been made until there was a fair prospect that before long they would be replaced by some other photometrical standard. The Metropolitan Gas Referees, whose instructions on this subject have been recently published,* are naturally looked upon as the protectors of the standard candle, doubtless because they are the only body having legal authority to define this standard and fix requirements in its manufacture. Moreover, they are in the most favourable position for studying the question, and ascertaining the effect of the various details of manufacture upon the candles. Doubtless the present instructions might have been extended with advantage; and it is possible that additions may be made to them in the future.

It has been the practice of the writer for several years to make a partial examination of samples from each new lot of candles received. This included the weight and dimensions of the candle, the strands and threads in the wick, and frequently the ash yielded by the wick. Since the publication of the Referees' instructions, a more extended examination has been made of six candles, from each of six different lots—all of them of reliable English manufacture. The results show great variations, and that in no case do the candles comply with the requirements contained in the instructions. For convenience, the candles have been lettered lots A, B, C, D, E, and F.

Wicks.—These were first separated from the sperm by means of a gentle heat, and then thoroughly exhausted with ether. They were then weighed, and the number of strands, threads, and plaits determined; after which they were thoroughly exhausted with water, dried and ignited for the ash. The instructions direct that each wick shall contain three strands of 18 threads each. In the candles examined, the wicks had in all cases three strands; but the number of threads varied from 18 to 24—being, in the different lots, 18, 21, 21, 23, 24, and 23 respectively. There should be from 32 to 34 plaits in 4 inches of the wick when straightened out on a rule. The candles in question contained 35, 27, 30, 31 to 33, 29 to 33, and 33 plaits. Twelve inches of the wick from each lot of candles, before exhausting with water, weighed 7·51, 6·87, 6·68, 7·76, 7·81, and 8·84 grains respectively; whereas the instructions direct that this weight shall not exceed 6·5 grains, nor be less than 6 grains. The ash from ten wicks, after treatment with water, should not exceed 0·025 grain. In the present examination, the ash for ten wicks was calculated from that obtained from the six wicks used, and the results were as follows: 0·077, 0·041, 0·041, 0·046, 0·051, and 0·103 grain. As will be seen, these figures are much in excess of that allowed by the Referees. In the last case, the ash collected on the end of the wick as the candle burned, and became more or less incandescent. A further examination of the ash in this case showed the presence of a large percentage of lime.

Spermaceti.—The melting-point was determined by means of capillary tubes, as directed by the Referees. The sperm from the different candles of each lot was mixed; and the figures given represent the averages of several tests, in which the extremes did not exceed half a degree in any one sample. According to the instructions, the spermaceti should have a melting-point from 112° to 115° Fahr.; and this would be slightly raised by the addition of the 3 per cent. and 4·5 per cent. of beeswax, melting at about 144° Fahr. The following are the figures obtained: 111·5°, 110°, 108·7°, 110°, 110·7°, and 110·7°.

Candles.—These should "each weigh, as nearly as may be, one-sixth of a pound." This is equivalent to 1166·6 grains each—a figure which, in our experience, few standard candles ever approximate. Indeed, we do not remember ever to have weighed a standard candle which equalled one-sixth of a pound. The average weight of the 36 candles examined was 1138·4 grains; the lightest was 1126·5 grains; and the heaviest was 1153·5 grains. The average of each lot was as follows: 1132·3, 1141·1, 1135, 1139·6, 1139·3, and 1143·2 grains.

Buoyancy.—The buoyancy test given by the Referees furnishes varying results, even in the same lot of candles. If a 40-grain brass weight is attached to the wick, and the candle is immersed in water, at 60° Fahr., with the taper end downwards, it should still float on placing a 2-grain weight on the butt, but should sink under a 4-grain weight. In lot A, one candle sank without any additional weight, three under 2 grains, and two under 4 grains. In lot B, one sank under 4 grains, two under 6 grains, two under 8 grains, and one under 10 grains added weight. In C, two sank without additional weights, two sank under 1 grain, and two under 2 grains. In D, one sank under 4 grains, three under 6 grains, and two under 8 grains. In E, one sank without adding weights, two sank under 2 grains, and three under 4 grains. In F, four sank under 10 grains, and two under 12 grains.

The foregoing may be taken as representing the standard candles at present obtainable in this market; and it remains to be seen to what degree of perfection they may be brought under the Referees' instructions. Certainly this is a move in the right direction, and undoubtedly it will result in considerable improvement, and thereby conduce to the moral rectitude of photometrists.

* See JOURNAL, Vol. LXII., p. 1133.

PROPOSED GAS-FITTING BUREAUS FOR NEW YORK.

A Bill is before the Senate of the State of New York to create bureaus of gas-fitting, and to amend the Act creating the Department of Buildings in the city. The following are the chief features of the measure:—

By the first clause it is provided that there shall be in the Department of Buildings in the City of New York, or in the Health Department, or the Board of Health, or Health Board, in every other city, town, and village in the State of New York, a bureau to be called the Bureau of Gas-Fitting. The chief of the bureau is to be called the Superintendent of Gas-Fitting; and there are to be one or more subordinate officers, who are to be called inspectors of gas-fitting and gas-fitters. Each of these inspectors is to have a technical and practical knowledge of gas-fitting, and at least ten years' experience as a gas-fitter. All the officers or employees of the bureau are to be appointed and removed in the manner now provided by law for the appointment and removal of officers in the Department of Buildings or Health Department. The various bureaus are to have charge of the construction and management of the work of gas-fitting, and are to enforce all provisions relating to rules and regulations, orders and requirements, made in regard thereto under the proposed Act. These regulations are not to conflict in any manner with the following rules: "(1) Gas-pipe fitting shall be done after and according to the rules and regulations as now used, adopted, and put in force by the several gas companies of the State of New York or standard rule of gas-pipe fitting. (2) All pipes shall be cut in beam not more than 18 inches from support or bearings, and also shall be tested by a mercury gauge so that the mercury therein shall be raised at least 18 inches, and shall continue to be so raised to the height of 18 inches for a period of time not less than 30 minutes."

The second clause provides that there shall be at least two inspections of gas-pipe fitting before the work shall be passed by the bureau, and the "proof ticket" (hereafter referred to) issued—the first, when the pipe is put in and fitted and completed, and before lathing is put on or flooring laid; and the second, when the brown mortar is put on and the flooring is laid.

The third clause specifies that no company are to do any gas-fitting of the kind known as piping inside or outside a building, except fixing a meter, and connecting its inlet and outlet pipes.

The next three clauses are as follows: "(4) There shall be at least one inspector of gas-fitting in every city, town, and village of the State of New York, except that in every city of over 300,000 inhabitants there shall be two inspectors, and for each 250,000 inhabitants, or fraction thereof, there shall be one inspector; except, however, that in cities, towns, and villages of less than 50,000 inhabitants the duties of the inspector of gas-fitting shall be assumed and discharged by the inspector or inspectors of plumbing, or officers discharging the duties of that position, in such cities, towns, or villages. (5) The inspectors of gas-fitting shall be appointed by the Department of Buildings, or the Health Department, Board of Health, or Health Board respectively, and shall be entitled to, and they shall receive, for their compensation the yearly sum or salary of $1200, payable in equal monthly payments, except when the duties of the inspector of gas-fitting shall be discharged by the inspector of plumbing, in which case the inspector of plumbing shall not be entitled to any extra compensation for performing the duties of inspector of gas-fitting. (6) The bureaus or the inspectors thereof shall have the right and are hereby empowered to inspect any gas-piping and fixtures—viz., chandeliers, side bracket lights, gas-stoves, gas-ranges, and all such other fixtures as may be used for illuminating, heating, or cooking purposes—at any time after the expiration of 48 hours from the time when the owner thereof, or the person having the care or possession thereof, was notified of such intention to so inspect the gas-piping."

By the seventh and eighth clauses, it is provided that, when the inspector has been satisfied that the gas-fitting or repairing work has been properly done, his bureau is to issue to the owner or interested party a certificate to be called the "proof ticket;" and that no gas company are to be allowed to introduce gas into any building in course of erection, or to which repairs are being made necessitating changes in the arrangement of the gas-pipes therein, until this ticket is produced to them.

The ninth clause contains directions as to the provision of the necessary offices, books, stationery, &c., and the charging of the expenses of the bureaus upon the districts concerned.

The tenth clause provides that "any person violating any of the provisions of this Act, or any rule or regulation of the Bureau of Gas-Fitting or the Board of Health or the Health Board respectively, shall be deemed guilty of a misdemeanour; and, upon conviction, shall be punished by imprisonment of not less than one month nor more than one year, or a fine of not less than $50 and not more than $500, or both." The parties to prosecute are to be the Attorneys of the respective public bodies, acting on behalf of the heads of Departments.

The remainder of the Bill consists of the customary repealing and enacting clauses.

THE NEW WATER SCHEME FOR CARLISLE.

A Special Meeting of the Carlisle Town Council has been held to receive the Water Committee's report upon the proposed extension and improvement of the water-works (see *ante*, p. 451). The Committee recommended that the No. 3 scheme of the Engineer (Mr. J. Mansergh) should be adopted, and that they should be empowered to take such steps as were necessary in the matter. The adoption of the report and recommendation was moved by Mr. Forster, who said that some eighteen months ago, the Council gave power to the Water Committee to call in an engineer to advise them on the present water supply; and they therefore consulted Mr. Mansergh, who paid a visit to Carlisle and took a survey of the district as well as of the present water-works. His first report as to the cost of a gravitation scheme was £213,000; and for extending the pumping in connection with the present works, £84,000. The estimate for the gravitation scheme being so large, the Committee could not entertain it; and, thinking Mr. Mansergh had been misled as to the quantity of water at Mosedale, they took pains to have the water gauged every day for three months during last summer. They found at the end of the drought that there were nearly 4 million gallons per day flowing; and with this information, they forwarded the figures to Mr. Mansergh, to see if he could not reduce his estimate. The result was that he sent his son down to test the correctness of the gaugings, and found the quantity correct. Mr. Mansergh, therefore, sent another report, and the estimate of the cost was £90,000. To make matters more sure, however, the Sub-Committee paid a visit to London to see Mr. Mansergh and Mr. Balfour Browne, Q.C.; and the former gave them distinctly to understand that the gravitation scheme could be carried out for that amount or less. The Committee had, therefore, every confidence in recommending the adoption of the scheme. Mr. Creighton, who seconded the motion, stated that the Committee had all along had the advice of their own Engineer (Mr. J. Hepworth), in whom they placed the greatest reliance, and in whose opinion it would not be safe to rely much longer upon their pumping machinery in the Stoney Holme, which had been at work nearly fifty years. With regard to the cost, it would be noticed that the Committee based their calculations on an estimate of £110,000, as they had thought it advisable to put a good round sum on for eventualities. As there was no doubt they would be allowed fifty years for repayment, this would make the annual charge, at £4 2s. per cent., £4510. At present they were sending out £7500 worth of water; and deducting one-fifth for working expenses, this gave them a total cost of £6010. He assumed it would take four years to carry out the scheme; and by 1899 they reckoned they would have paid off all instalments on their loans on the water-works, except about £300. Adding this to the £6010 made an annual charge of £6300; and with an estimated revenue of £8000 in 1900, this would leave a margin of profit of about £1600. The Committee had thrown on one side any idea of improving the pumping scheme, and asked the Council to adopt the gravitation project; and what they said was that in 1900 they would have a profit of £1600 per annum, as compared with a net profit at the present time of £2100 to hand over to the district fund. It must be obvious to all the members that it was better to adopt a gravitation scheme, which, at the end of fifty years, would be the property of the town, than to go in for a pumping scheme, and have worn-out machinery at the end of thirty years, and pumping expenses going on for ever. An amendment proposing that the consideration of the question should be deferred was moved and seconded; and afterwards Mr. Hough commented upon the financial aspect of the scheme. On the suggestion of Mr. Creighton, Mr. Hepworth then made a statement on the principal features of the question. He said the existing works had cost £70,000, of which only £16,000 was now outstanding; and the works had been paid for not by the ratepayers, but by the consumers. It was not proposed to increase the rates, but to bring to Carlisle a better supply of water at a higher pressure. At present the district rate benefited to the extent of £2100 a year from the works. If the scheme were carried out, there would at first be only £1600 to hand over; but the amount to be paid would soon reach the present figure. Proceeding to deal with the urgency of the case, he showed how the demand for increased supply had only been staved off by diminishing the waste; but complaints were still frequent of the want of pressure at Newtown and other parts of the district. As to the cost of the proposed works, he should be surprised if they cost as much as had been calculated in the estimate; and the repayments had been reckoned on the basis of paying 3¼ per cent. for the money. He believed the Corporation could borrow at less; and the Mayor had now in his pocket a letter offering the money at less than 3 per cent. When the water-works were previously extended, he was supposed to have said they would last for 25 years, but that was not what he did say. What he said was the filters might be expected to last for 25 years. Within the past five years, more had been learnt about filtration than during the preceding 25 years; and no engineer constructing filters now would do so in the same way or with the same area as he would have done five years ago. A chemical analysis used to be sufficient for ascertaining the purity of water; but now no one would be satisfied without having a bacteriological examination. Such a test had been made; and the report received by him since the last meeting of the Committee showed that, by very careful filtration, and by taking the water only when it was at its purest, they could remove 90 per cent. of the bacteria to be found in it. All this pointed to the fact that, if they depended on the Eden, they would be bound by-and-bye to take the steps Mr. Mansergh had foreshadowed in his £84,000 scheme for increasing the filtration. Directly they had spent £30,000 or £40,000 on a larger reservoir, they would also find themselves called upon to take steps to make the water absolutely pure. Mr. White opposed the scheme; and, in the course of his remarks, he defended the quality of the Eden water, showing how favourable were the analyses even of water taken before it had been filtered. After two or three other members had spoken, the debate was adjourned.

The Torquay Water Question.—Since the poll of the ratepayers was taken which defeated the proposal of the Torquay Town Council to purchase the watershed at Tottiford and Kennick, the Water Committee have determined to ask an eminent expert to report.

THE PREVENTION AND DETECTION OF WASTE OF WATER.

At the Meeting of the Institution of Civil Engineers last Tuesday, a paper on this subject was read by Mr. E. COLLINS, M.Inst.C.E.

The author commenced by pointing out that the term "waste of water" comprises: (1) Visible waste above ground, caused by defective mains or pipes, or by unsound and unsuitable house-fittings. (2) Hidden waste, arising from broken pipes underground, or from faulty mains and services, where the water escapes unperceived, and finds its way into sewers or disused drains; also that arising from secret overflows from baths, cisterns, underground tanks, gas-engine coolers, &c. (3) Wilful waste, caused by leaving taps open and tampering with fittings. (4) Undue consumption of water, which, although used wastefully, is serving some useful purpose. The first two kinds of waste could, he said, be dealt with by systematic inspection, constant supervision, and the employment of suitable appliances. Wilful waste was troublesome to discover, while it was still more difficult to find the offender; and it was most difficult to obtain his conviction when found. Undue consumption was hard to define; as what some might hold to be unnecessary consumption, others would consider a legitimate use of water. Among fittings causing undue consumption, the author regarded the automatic flushing-tank as a very objectionable form of apparatus. Another frequent cause of undue consumption is the faulty design of closet-pans, which he thought should be so constructed that the jet of water might act on the soil to be displaced in the direction of the outlet. Where this is carried out, the regulation allowance of 2 gallons at each flush would, he said, suffice.

Hydraulic motors, lifts, and elevators, when worked off comparatively low-pressure mains suitable for ordinary domestic or trade supply, occasion undue consumption of water. Ornamental fountains and careless garden-watering also give rise to excessive use of water, and, in some cases, to wilful waste. Mr. Collins pointed out that one of the chief means of preventing waste is the introduction of thoroughly efficient fittings into the houses of consumers. The regulations made with the approval of the Board of Trade, under the Metropolis Water Act, 1871, are among the main difficulties which embarrass Water Companies in London. He believed many of these regulations were in themselves good; but they were so hedged by precautionary clauses as to render them frequently abortive.

In 1883 the Directors of the New River Company were called upon by the Local Government Board to change certain districts within the area of their supply, containing about 22,000 old houses, from the intermittent to the constant system. Attention having been directed to their responsibility, and to the difficulties which would have to be encountered, especially in the provision of suitable water-fittings, they empowered the author to introduce a system of testing and stamping them, with a view to aid consumers to obtain good fittings, and to protect them from the annoyance and loss resulting from the use of inferior apparatus. The system then introduced has developed extensively; and there has been a material improvement in the quality of the fittings. Manufacturers who were at first antagonistic have become strong supporters of the system, so much so that the use of untested and unstamped fittings in the district of the Company is almost the exception; and where such fittings are used, they are invariably of the strength and proportions recommended by, and in accordance with the regulations of, the Company. Every fitting received to be tested is taken to pieces; and each part is superficially examined, gauged, and weighed. It is afterwards stamped as approved by the Company.

The idea of detecting waste by means of meters was introduced many years ago; and a method of measuring the flow of water in pipes in any given time was invented in 1854 by William Peace. The Deacon waste-water meter was the instrument most generally in use; but equally good results could be obtained from the Tylor meter. Many years ago the Kennedy meter was employed for the detection of waste in water-works; the meter, being placed upon wheels, was utilized, with a hose attachment, at any part of a district where it might be required. Very good results were so obtained, although the feature of measuring the quantity in a given time was not utilized. The Kennedy meter has now been adapted, with a clock-and-drum arrangement, for the detection of waste. Another suitable instrument is the Ginman meter—being an adaptation of the reflux-valve in combination with a clock and drum; but it is at present little used.

A waste-water meter would enable an inspector to see at a glance the precise locality in any district where waste was taking place. The expense of the introduction of the system was considerable; the author's experience showing that, in many districts in London, it involved an outlay of about £150 for every 1000 houses so controlled. This sum included the cost of the meters and of fixing them on a bye-pass, with sundries incidental to the fixing of valves for isolating the divisions of the district. In laying out districts for the waste-meter system, Mr. Collins said care should be taken that the district to be controlled by the meter was not too large. He had found from experience that a 4-inch Deacon meter could well control about 400 or 500 houses; but districts smaller than this were desirable. Generally a large district was neither satisfactory nor economical in working. It necessitated more careful manipulation, and an increased number of divisional valves added to the labour of the inspectors in order that accuracy might be insured. It was possible, with some contrivance, for a waste-water meter to control 2500 houses; but an existing district could very seldom be so arranged.

Although the use of waste-water meters was effective, and indispensable for a constant supply, Mr. Collins said it had been frequently urged that it involved a heavy initial outlay and annual expenditure for the staff. The heavy outlay might, he thought, be admitted; but the maintenance of an expensive staff exclusively in connection with the waste-meter system, was an unfair inference from the facts. The system was, indeed, most economical, because it enabled the staff to efficiently cover and keep in order much larger districts than it could otherwise cope with. If the meters were, as they always should be, constantly worked, they continued to indicate clearly the localities where waste existed, and thus to keep the staff continually on the alert. To deal effectually with the suppression of waste in extensive districts without

waste-water meters, a much larger staff of inspectors would be necessary; and, even with a very large staff, a great number of hidden leakages would be altogether missed, which the waste-water meter effectually detected. The quantity of waste from this source had been found to be between one-third and one-half of the total amount of waste. In some instances, meters were purchased and fixed at considerable expense, and diagrams were taken off at stated periods, while few steps were taken to rectify the defects which the meters were constantly indicating. The meter system was then condemned as useless; whereas in most of such cases the men in charge were really blameable, and endeavoured to hide their shortcomings under a condemnation of the system.

The author then proceeded to describe in detail the plain adopted by him for the efficient working of the waste-water meter system. By means of this system, he had, dealing with an estimated population of 87,000 in Shoreditch, effected in the course of three years a diminution of waste and undue consumption amounting to 720 million gallons per annum. This was done at a capital outlay of £1800, and an annual expenditure of £926 for staff and establishment charges.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Falkirk Town Council are going deeper into the mire in the matter of acquiring the lighting of the burgh, as they call it, which is, however, nothing more nor less than the taking over of the Gas Company's undertaking. The Company are in Parliament, seeking incorporation and powers to extend their works; and the Corporation have lodged an opposing Bill, in which they ask powers to set up opposition gas-works. This, on the face of it, is an absurd position for the Corporation to take up. Its only justification is that it may be considered good tactics to present a front to the Company; but that could only be a sensible thing to do if they could show that they really meant what they proposed. This position they have not taken up, but rather the opposite, which must tell against them when they go before a Parliamentary Committee. That they have no very great intention of proceeding with their own Bill, is shown by their eagerness to get the Gas Company to agree to arbitration for the acquisition of their undertaking. To be sure, there is nothing out of place in their taking up a hostile attitude by lodging their Bill, and afterwards seeking to negotiate with the Company. Where the Corporation are erring is in their method of proceeding to negotiate for the arbitration. First of all, on Jan. 13 they applied to the Company for permission to have the works inspected by two engineers, and the books examined by an accountant. Had this been done in good faith, with the intention of using the reports only as evidence in the arbitration, it would have been right, and permission would probably have been granted; but it was not; and so the Gas Company refused. A second request was made on Jan. 22, with the intimation that the engineers would be in the town on the Friday following, and the threat that if any obstruction were shown to them it would be explained to Parliament. This naturally led to a more emphatic refusal by the Secretary to the Gas Company, who pointed out that the request was made "with the view of advising the Council in the present position of matters generally." Thus the purpose of the Corporation, which was to obtain evidence to be used against the Company, was exposed. It was rather an impudent proposal by the Corporation. Their next move was, if anything, still more impudent. On Feb. 14, they wrote to the Secretary of the Company, offering to purchase the undertaking at a price to be fixed by arbitration; but stipulating that the valuation should not be on the basis of a compulsory purchase, and that it should be open to the Commissioners to urge any objections relating to the condition and suitability of the works, machinery, and plant. To this the Company replied that, though they had no wish to sell, they were willing to arbitrate in terms of section 21 of the Burghs Gas Supply (Scotland) Act; but they declined the conditions of the Corporation. On March 1 the Town Clerk again wrote to the Secretary to the Gas Company, practically repeating their offer; and to this no reply was sent.

The quality of these communications is not apparent, unless the remarks of Mr. Storey at a Council meeting on Monday are considered. This statement was to the effect that it must be clear to all that there had been an earnest desire on the part of the Lighting Committee to have the question settled in Falkirk, without going to London and incurring the expense of a parliamentary contest. That is just what I do not read into the documents. Had there been an earnest desire to negotiate, nothing could have been easier than for the Corporation to have made an offer, with a pledge that whatever information they derived would not be divulged unless in the arbitration, and certainly would not be founded upon before a Parliamentary Committee. The Company would then have been put in a corner had they declined to allow inspection. As it is, the Corporation have cornered themselves by approving the action of Mr. Storey and his Committee. They cannot now stand before a Parliamentary Committee and say their main object is to promote their own Bill; neither, supposing they admit that their own Bill is but a kite, can they state that they have made a reasonable offer to the Company. How they have landed themselves in the position they are in is not, of course, for me to investigate; but it seems to be disclosed in the remark by one of the speakers at Monday's meeting, that Mr. Storey never came before the Committee with his own opinion on any delicate question, but consulted those best qualified to advise him on the matter. That is just it. A mountain of technical difficulty has been raised where a particle of common-sense and good-will between neighbours would have paved the way for an understanding. If the Corporation could see it, their position is this, that they will either, after a costly parliamentary contest, get their own Bill, and have to bear the expense of erecting new works, with the disadvantage of having to compete with the Company, or they will have to take over the Company's undertaking by arbitration, and pay the costs of the arbitration. In either case they will have the expenses of the contest to pay; the Company, of course, in the event of the Corporation Bill being passed, paying their own costs. As, however, it is the acquisition of the Company they are after, the question for them is whether they will get, after going to Parliament, terms which will be so much cheaper than what they would obtain by voluntary arbitration, without the costs of the parliamentary contest. They should have little difficulty in making up their mind on this subject. They know the capital of the Company, and the dividends which have been paid. Any engineer could give them a reasonable estimate as to what it would cost to put the Company's works in order, on the assumption that they require a good deal of renovation—which may be taken for granted, when the Company are seeking powers to construct new works; and, having arrived at a price upon capital and dividend, they could deduct the estimated cost of renovation, and make an offer to the Company. Goodwill would, of course, require to be taken into account, and a fair offer made, without any attempt to beat down the price; otherwise the affair would be a farce. But if such a step as this were taken, it would greatly strengthen the position of the Corporation if they should afterwards require to go before a parliamentary Committee. They do not need to expect, if they go to arbitration after a contest, that anything other than a fair price will be fixed; and that is all the more reason why they should endeavour to come to terms. Looked at in any way, it is preferable that an open, friendly understanding should be come to, rather than that the parties should continue fighting from behind the battlements of technicalities, with the aid of paid advisers, whose action is, in all cases, if not automatic, at least mechanical.

The bad weather of the past two months has led to an increased consumption of gas. This is shown at Perth, where the output last month was 182,500 cubic feet more than in the corresponding period of last year. It is to be remembered, too, that the increase is with enriched gas, of an average illuminating power of 29·26 candles. Had the gas been coal gas only, the presumption is that the increase would have been greater. At a meeting of the Gas Commission on Monday, a proposal was made to modify or abolish meter-rents. This was opposed, on the ground that it would lead to their blotting out an asset of £12,000 which they have sunk in meters; and, on the suggestion of the Lord Provost, the subject was delayed till the time comes for making up the annual estimates. The Commissioners are about to consider whether they should not promote a Bill to convert their annuities into redeemable stock.

A deputation from the Paisley Town Council, including Mr. G. R. Hislop, the Gas Manager, on Saturday last visited Perth, to inspect the oil-gas plant in use there; and they returned highly satisfied with what they had seen.

The Portobello Town Council have resolved to erect several incandescent gas-lamps in the public streets, as an experiment. It will be remembered that the Council two or three months ago remitted to a Committee to consider as to the lighting of the burgh, and that the Committee have been negotiating with the Edinburgh and Leith Gas Commissioners for the purchase of gas from them in bulk. The motion to introduce incandescent lamps was made in the interest of the local Gas Company; and it was adopted, though not without some opposition from those members of the Council who favour a supply being obtained from Edinburgh or Leith.

On Monday night the Royal Scottish Society of Arts had before them the report of the Committee they appointed to consider Mr. John Laing's paper on his oil-gas process, read before them on Nov. 27, and published in the JOURNAL on Dec. 5 last. The Secretary read a letter from Mr. Laing, objecting to the report, which gave rise to some discussion. Ultimately the report was read. It was to the effect, practically, that there was nothing new in Mr. Laing's invention. Thereafter Mr. Laing asked leave to make a statement; and this having been granted, he read a paper in which he controverted the statements in the report—a copy of which had been sent to him before the meeting—and maintained that the Committee could not report on his invention till they saw it at work, which they could do now at Linlithgow. A discussion, in which considerable heat was developed, took place, some of the members insisting that Mr. Laing should withdraw some of the expressions in his paper, and particularly one which seemed to indicate that some of the members of the Committee were interested parties, before the Committee could be asked to further consider the subject. Ultimately Mr. Laing agreed to withdraw both his letter and statement; and the subject was sent back to the Committee. Dr. Stevenson Macadam, however, pointed out that the Committee could only deal with the original paper; and not with anything they might be shown, unless Mr. Laing were to submit another paper giving the results of the working of his plant. In view of the fact that the Committee's report is not a final one, it would be inadvisable to comment upon it. Mr. Laing's attitude is in a different position. He either should not have read his original paper until he was able to give results, or, having read it, while the process was still only a theoretical one, he should have requested the Committee itself to delay reporting until he had had an opportunity of making his communication complete. The Committee are not likely to look more favourably on his scheme after his attacking them. His invention, as well as that of all others, deserves to be treated with fair play; and he has himself to blame if it is not, because of his bringing it forward in a premature and fragmentary manner.

The Bradford Corporation Nidd Water Scheme.—The Water Committee of the Bradford Town Council have accepted a tender submitted by Messrs. T. Piggott and Co., Limited, of Birmingham, for the supply of mild steel pipes required in connection with the new water-works, amounting to £29,568. Their decision has been approved by the Council.

The Hours of Gas Workers at Leeds.—A deputation of eight workmen, representing the enginemen, foremen stokers, and pressure men employed at the gas-works, attended a special meeting of the Leeds Corporation Gas Committee last Tuesday with reference to an application they had made to be placed upon the eight-hour system. After hearing the views of the deputation, the Committee discussed the matter, but eventually adjourned, with a view to further considering the question, and to preparing a scheme whereby, if found practicable, the proposal of the men can be carried into effect.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March 17.*

Sulphate of Ammonia.—The absence of Continental and American demand does not seem to affect the market—in fact, prices are rather on the hardening scale. This is certainly an anomalous position; and it must be ascribed to either a reduced production, or to a considerable amount of surreptitious buying, for shipments proceed in the usual scale, and stocks do not accumulate. There has been a large "bear" account open for a considerable time; and it may be that the necessities of these dealers make the market what it is. The exceptionally bright weather is not conducive to increased supplies, and it is well for the consuming portion of the trade that they have been able to do with less sulphate, and been putting off purchases in many instances; for any larger demand than the existing one would have inevitably sent prices to an extreme level. Buyers are, however, not "out of the wood" yet; and the season is by no means at an end. Those who still hope for a lowering of values will, in all probability, be disappointed. Quotations to-day are £14 to £14 2s. 6d. Nitrate is dearer; and now 9s. 9d. is required.

LONDON, *March 17.*

Tar Products.—The production of tar is now rapidly falling off; but, from all appearances, the season will end with less stocks in distillers' works than in former years. There is a slackened demand for most products, though some considerable business is reported in anthracene. The value of benzols continues most unsatisfactory. It is hoped, however, that the lessened production will prevent prices going lower. The position is a remarkable one, as solvent naphtha to-day is worth as much as 90 per cent. benzol. Carbolic acid is moving off fairly well; but cresylic acid does not appear to be wanted. Several important tar contracts are reported as being entered into at prices ranging from 13s. to 16s., according to position. Other values may be taken as follows: Pitch, 26s. Benzols, 90's, 1s. 2d.; 50's, 1s. 4d. Creosote, 1¼d. Creosote salts, 25s. Solvent naphtha, 1s. 2d. Toluol, 1s. 6d. Cresol, 1s. 4d. Crude benzol naphtha, 30 per cent., 6½d. Carbolic acid, 60's, 1s. 8d. Anthracene, 30 per cent., "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia is firm; and, according to port of shipment, the price has fluctuated between £13 16s. 9d. and £14 2s. 6d. Considerable quantities are now going into home consumption. Shipments are large; and stocks continue remarkably low. The gradual improvement of sulphate has enabled makers to pay a higher price for gas liquor, which is now quoted at 11s. 6d. to 13s., according to position.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position as regards all descriptions of round coal becomes more and more unsatisfactory; and there is a general weakness and irregularity in prices—at any rate in the open market—which is necessarily checking actual business coming forward just at present, in the way of contracts of any weight for forward delivery. The coalowners in this district, connected with the Lancashire Coal Sales Association, who have been endeavouring to hold up prices, have found other districts giving way, with the result that a good deal of their regular trade has been secured by representatives of collieries in Yorkshire, Staffordshire, and Derbyshire; and the question just now uppermost is, if the competition is already so keen, what is likely to be the position when the important contracts for gas coal and locomotive fuel come upon the market. In some quarters, the opinion is expressed that the prices which will be quoted to secure these contracts may get back to very much the same level as last year; and with the outlook so uncertain, there is no disposition to be in any hurry about placing these contracts. What the result of the conference with the representatives of the Yorkshire gas-coal collieries has been or is likely to be, has not, so far as we are able to ascertain, transpired; but the keenness with which Yorkshire coalowners have been competing for other trade will scarcely favour any confident anticipations that they will co-operate with Lancashire in holding out very firmly with regard to the gas-coal contracts. With the Lancashire Coal Sales Association split up into so many districts, each guided by its own requirements, it is difficult to arrive at any really general fixed prices; but taking round coals all through, they are certainly gradually getting back to something like the rates which were ruling before the stoppage—being, as a rule, quite 2s. 6d. to 3s. per ton under those quoted when work was resumed. At the pit mouth, best Wigan Arley coals are only in exceptional cases fetching more than 12s. to 12s. 6d.; whilst Pemberton four-feet and second qualities of Arley can be bought at 11s. to 11s. 6d. The commoner qualities of round coal, which usually go for house-fire and gas-making purposes, are about 9s. to 9s. 6d. per ton; with steam and forge coals about 8s. to 8s. 6d. per ton. The shipping prices for round coal have got to a very low point; and the official Coal-Sales Association quotations are 9s. to 9s. 6d. per ton delivered at the Garston Docks or the High Level, Liverpool, which may be taken to certainly represent the maximum figures in the market. With very few collieries working more than four days per week, and stocks accumulating with this limited output, there is necessarily only a restricted production of slack; and this is causing engine classes of fuel to be very firm, with, if anything, rather a hardening tendency. Good qualities of burgy fetch 8s. to 8s. 6d.; best qualities of slack, 6s. 3d. to 6s. 9d., with some special sorts, 7s.; and common, 5s. to 5s. 6d. at the pit mouth.

Northern Coal Trade.—There has been a little more activity in the coal trade of the North-east during the last few days; but it is unequally distributed, and there are many of the collieries which have had of late short work. There is a slightly better demand for steam coal; and best Northumbrian kinds are quoted at from 10s. 1½d. to 10s. 3d. per ton f.o.b., with second qualities about 9s. 6d. per ton. Small coal is being shipped rather heavily; and thus it is somewhat scarce, and commands about 4s. 3d. to 4s. 6d. per ton. There is still a fair demand for gas coals, though it is less than it was; deliveries being now lower naturally. There is, however, rather a disposition in some quarters to keep larger stocks of coal at gas-works; but so far the labour question in the Durham coal-field is peacefully settled. The price quoted for best Durham gas coal varies between 7s. 3d. and 7s. 6d. per ton f.o.b.; but one or two collieries, exceptionally situated, still ask 8s. per ton. Some contracts for foreign gas companies are now nearing settlement; and the prices agreed upon will be looked for with great interest. Manufacturing coals are steady, with a rather increased demand for shipbuilding purposes. In the coke trade, the limited export is one of the worst features; but the local consumption is increasing, and there is a rather better prospect of the demand for the North-Western blast-furnaces. The price varies from 13s. 6d. to 14s. 6d. per ton f.o.b. There is no alteration in the price of gas coke; but the house consumption seems to increase.

Scotch Coal Trade.—The coal trade in Scotland is in a dragging condition. There is a fairly good home consumption; but the shipping demand is falling off. A blow has been experienced in that line by the diversion of the Danish railway contract almost entirely to England and Wales. In former years, about 60,000 tons used to be taken; but this year only somewhere about 7000 tons of Slamannan coal has been contracted for. This indicates easier terms south of the Border, and would lead to the conclusion that a reduction in prices in the North should be resorted to. Coalmasters are, however, averse to further reducing prices; preferring rather to restrict output, which they are doing by cutting down the working days. This is most apparent in the West of Scotland, where from two and a half to four days are, in many cases, being worked. In Fifeshire and the Lothians, better time is being got by the miners. The men's delegates in the West met this week, and resolved on a four days' policy, to endeavour to distribute work; but the Lothians men met on Saturday, and resolved to continue the Conciliation Board they have had for several years. There is thus disunion among the men, which will prevent them giving trouble for some time. Ell coal is most in demand; main and splint are less so. The prices quoted are: Main, 7s. to 7s. 3d.; ell, 8s. 3d.; splint, 8s. 3d. to 8s. 6d.; and steam, 9s. 3d. to 9s. 6d. per ton f.o.b. Glasgow. Shipments for the week amounted to 111,115 tons—a decrease, as compared with the previous week, of 13,480 tons, but an increase of 5096 over the corresponding period of last year. For the year to date, the total shipments have been 1,253,773 tons—an increase of 287,388 tons upon the corresponding period of last year.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 521.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p.c	10	12½—13½	+½	5 11 1
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 6
100,000	20	14 Dec.	8	Bahia, Limited	20	10½—11⅛	..	13 18 3
800,000	5	15 Nov.	6½	Bombay, Limited	5	4½—5	..	6 10 0
40,000	5	,,	6½	Do. New	5	3⅞—4	..	6 10 0
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	163—168	+1	5 1 2
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	205—215*	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Sept.	11½	British	20	46—48	..	4 13 9
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	+1	5 4 7
51,510	10	,,	8⅛	Do. 7 p. c.	10	15½—16½	+½	5 3 0
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5⅝—6⅜	..	3 1 6
800,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	255—260	+2	4 16 2
165,000	,,	,,	9½	Do. New do.	100	193—197	..	4 16 5
160,762	,,	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	128—133	..	3 7 9
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—207	..	4 16 7
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	102—107	..	4 13 5
480,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15⅛—16⅛	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	233—238	..	5 0 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	97—100	..	4 0 0
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 12 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	174—178	+1	3 18 7
463,000	,,	,,	10	Do. I, 10 p. c. Prf.	100	270—275	..	3 12 9
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	212—217	..	5 10 7
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	109—111	..	4 10 1
541,920	20	15 Nov.	5	Monte Video, Limited	20	12¼—13½	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6—6½	..	6 3 1
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4½	..	7 15 6
166,870	10	31 Jan.	2	Pará Limited	10	1¾—2¼	..	8 17 9
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	103—109	+6	5 10 1
500,000	100	1 Dec.	6	and Do.	100	97—102	+1⅛	5 17 8
150,000	10	13 Oct.	5	San Paulo, Limited	10	8—9	..	5 11 1
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	313—318	..	4 17 6
1,350,000	,,	,,	12	Do. B do.	100	253—258	+3	4 13 0
260,000	,,	,,	13	Do. C do.	100	256—261	..	4 19 7
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	150—153	..	3 5 4
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	272—277	..	3 12 3
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	218—223	..	3 11 9
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	112—116	..	3 13 4
708,000	Stck.	28 Feb.	11½	Kent	100	288—293	..	3 18 6
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	250—255	..	3 14 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	200—205	..	3 13 2
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	130—134	..	2 19 9
500,000	100	14 Feb.	12½	New River, New Shares	100	365—370	−2	3 5 6
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V xnall, 10 p. c. max.	100	155—160	−3	3 15 0
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	265—270	..	3 14 1

*Ex div.

Exhibitions of Gas Appliances.—Messrs. Fletcher, Russell, and Co., Limited, have just held successful exhibitions of gas appliances at Bristol and Bath, with the assistance of Madame Alting-Mees as lecturer on cookery.——Messrs. Charles Wilson and Sons have been exhibiting their gas cooking and heating appliances at Weston-super-Mare. Miss Garstin gave a series of ten lectures on cookery, which were numerously attended.

New Joint-Stock Companies.—The Electricity Users' Association, Limited, has been formed, with a capital of £2000, in £1 shares, to insure against all kinds of accidents to electrical apparatus. Taylor's Smokeless Boiler Syndicate, Limited, has been formed, with a capital of £30,000, in £5 shares, to acquire certain patents relating to improvements in self-contained gas-fired steam generators, and to develop and turn them to account. The Somerset Petroleum Wells, Limited, is the title of a Company formed with a capital of £60,000, in £1 shares, to acquire the benefit of a licence and agreement for a lease to search for and work petroleum oil on the Ashwick Estate, near Shepton Mallet, Somersetshire.

Dover Gas Company.—In moving, at the recent half-yearly general meeting of this Company, the adoption of the Directors' report, the principal portions of which were given in the JOURNAL for the 6th inst., the Chairman (Mr. W. Mannering) stated that the Company might congratulate themselves on an increase of nearly 2 per cent.—to speak exactly, 1·8 per cent.—in the consumption of gas, when many similar undertakings were reporting a diminished output. With regard to the manufacturing operations, 8389 tons of coal were carbonized, from which 93,647,000 cubic feet of gas were produced, and 86,474,600 cubic feet were sold and accounted for; being equal to 10,380 cubic feet per ton. For this highly gratifying result, the greatest credit was due to their Manager (Mr. R. Herring). Owing to the late strike, the Directors had been compelled to resort to Durham coal, which produced less gas, and of lower illuminating power, than the Yorkshire coal to which they had been accustomed. However, by a more liberal use of oil as an enricher, the quality of the gas had been well kept up. He acknowledged with pleasure the excellent way in which the business of all the departments had been carried on; and thanked the staff and workmen for their faithful services.

The House of Lords and the Employers' Liability Bill.—A demonstration was held in Hyde Park last Sunday afternoon, under the auspices of various labour organizations in London, to protest against the action of the House of Lords with reference to the Employers' Liability Bill. A procession, carrying large numbers of banners, was organized on the Thames Embankment, and marched thence by the usual route to the Park, where an immense crowd assembled. A long array of speakers denounced the Upper House from twelve platforms. The proceedings came to an end about five o'clock by the passing of the following resolution: "That this meeting, representing the organized industries of the United Kingdom, condemns the action of the House of Lords in stultifying the decision of a majority of the directly elected representatives of the people in the House of Commons upon the Employers' Liability Bill. This meeting also calls upon the Government to reintroduce the measure at once to test the ultimate decision of the House of Lords, and to take steps for the entire abolition of the House of Lords, and thereby to deprive the Peers of the power of opposing the national will." A similar resolution was passed on Saturday at a conference of labour delegates held in the Memorial Hall, Farringdon Street.

Improved Retort-Settings at the St. Andrews Gas-Works.—Mr. John Dennis, of Dalkeith, has received instructions to erect retort-settings on the semi-regenerative principle at the St. Andrews Gas-Works.

The Driffield Gas Question.—The dispute between the Driffield Local Board and the Gas Company appears likely to be settled in an amicable manner. At a meeting of five shareholders of the Company and the Committee appointed by the Local Board last Saturday week, it was agreed that the Board should seek powers to purchase the property of the Company at a valuation. On this provisional agreement being approved by the Board and the Company, the latter are to withdraw the Bill which they have deposited in Parliament.

The Finances of the Stockton and Middlesbrough Water Board.—The Finance Committee of the Stockton and Middlesbrough Water Board have resolved to recommend the issue of precepts on the constituent Corporations for £9731, in the following proportions: Middlesbrough, one-half; Stockton, five-twelfths; Thornaby, one-twelfth. Of the total amount, no less than £3790 is to meet the taxed costs of the Act of 1890; and the remainder is for extensions of mains. The Committee also recommend the payment in the same proportions to the three Corporations of a sum of £12,000 out of net revenue.

Armagh Gaslight Company, Limited.—The annual general meeting of this Company was held yesterday, when the Directors reported that, having been fortunate in securing a favourable contract for their year's supply of coal, and the agreement having been entered into with a Scotch firm, they were kept free from the annoyance of the strike in England. The revenue amounted to £5278; and the expenditure, to £4660—leaving a balance of £1618. The net profit for the year amounting to £1283, enabled the Directors to recommend a return to the old rate of dividend—viz., 2s. per share, free of income-tax—and left a balance of about £200 to be carried forward. The Engineer and Manager (Mr. J. Whimster) presented a report in regard to the works, and made certain useful suggestions as to improving the storeage plant, which the Directors expressed their intention of adopting.

The Discovery of Petroleum in Somersetshire.—Since the petroleum discoveries at Ashwick, to which reference was made in the JOURNAL a few weeks since, considerable interest has been created among the residents, with the result that the neighbourhood shows the undoubted existence of oil in numerous other places; and it is being found exuding from spots previously unknown. Some mining engineers have been in Ashwick making arrangements for boring and completing the acquisition of mineral rights over the whole neighbourhood. Professor Boverton Redwood and Mr. Topley, who, it may be remembered, undertook to investigate the matter, have made their report. They state, as the result of their investigation, that sufficient oil exists in the locality to warrant any expenditure that may be necessary for boring. They are also of opinion that the detonations of a few charges of a high explosive in the well at Ashwick Court might have the effect of liberating deposits of the oil in the contiguous rock, and causing a further considerable flow into the well. This recommendation has been acted upon with satisfactory results; the water coming up thickly coated with oil. The above-named gentlemen state that the specimens of the oil obtained from the well were transparent, of straw colour, exhibited practically no fluorescence, and had an odour resembling that of refined rather than crude oil. It had a specific gravity of ·816 at 60° Fahr., and a flashing-point of 175° Fahr. by the closed test.

EASTER HOLIDAYS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than THE FIRST POST ON SATURDAY NEXT.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." GWYNNE & CO., TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

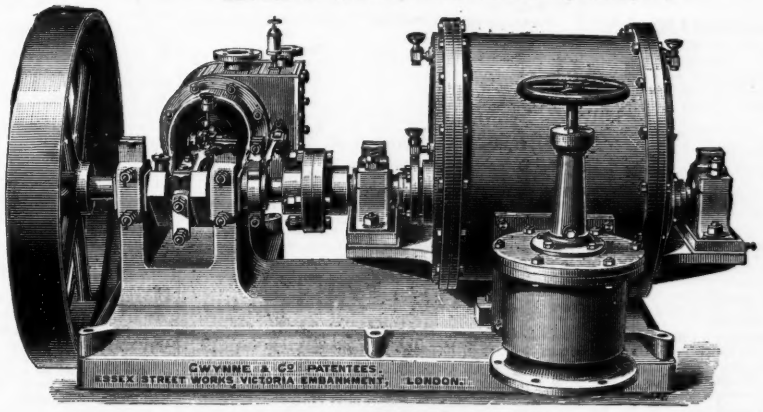
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See Advt., p. 506.]

ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: Volcanism, London."

LIQUOR, Tar, and Spent Oxide wanted. BROTHERTON AND Co., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

WANTED, a Situation, as Manager of small Gas-Works. Total abstainer. Age 29. Good references.

Address No. 2359, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS-STOVE MAKERS.

WANTED, a re-engagement as TRAVELLER. Moderate Salary and Expenses

Apply, by letter, to No. 2354, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Gas Engineer, an Engagement Abroad. Has had eight years' experience in South America as Engineer and Manager.

Apply, by letter, to No. 2355, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Meter Inspector or REPAIRER. Able to fix Meters. Five years' experience. Total abstainer, good testimonials.

Apply, by letter, to No. 2360, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A WELL-KNOWN Gas Expert, shortly disengaged, is open to engage with a good firm of Gas Engineers as REPRESENTATIVE at home or abroad.

Reply, stating terms, &c., to No. 2351, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO ENGINEERS AND MANAGERS.

WANTED, by the Son of a Water-Works Engineer, a Situation as ASSISTANT or otherwise, in the Office of a Water-Works Engineer or Manager. Has had four years' experience on Public Works and in General Office Routine. No objection to going abroad.

Address ENGINEER, Water-Works, PORTSMOUTH.

WANTED, a Situation as Gas Manager. Thorough knowledge of the Manufacture and Distribution of Gas from Retort to Burner, also the Manufacture of Sulphate of Ammonia. At present in a Works making over 21 millions. Has been in present employ thirteen years. Married. Good reasons for leaving. Also good Testimonials. Disengaged March 9.

Address No. 2342, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good Stoker, used to Generator Furnaces. Wages, 25s. per week from August to May, and 18s. from May to August.

Apply, stating age and where last employed, to J. C. BENNETT, Gas-Works, BRIDGNORTH.

WELLINGTON (SALOP) COAL AND GASLIGHT COMPANY.

WANTED, an Accountant and Manager. Particulars from the undersigned.

Applications, with copies of three recent testimonials, to be sent by the 24th inst., endorsed "Gas Manager" (canvassing will disqualify), to G. BIDLAKE, Secretary, Town Hall Chambers, Wellington, SALOP.
March 9, 1894.

TANK Trucks wanted. Full Particulars and lowest price to MAJOR, Sculcoates, HULL.

CHIPPING NORTON GAS COMPANY.

WANTED, New or Second-hand, four PURIFIERS, 8 ft. to 9 ft. square, 3 ft. to 3 ft. 6 in. deep, or, if not square, of a like capacity. Also a Centre-Valve thereto (if on latest principle), or four Four-Way Valves, all 6-inch Connections preferred. The same, if not new, must be practically as good. Quotations (delivered here) are invited.

Also FOR SALE three PURIFIERS 7 ft. 6 in. by 6 ft. by 3 ft. 6 in. deep, with Centre-Valve thereto, all 6-inch Connections, in excellent condition.

Address THOS. BURTONSHAW, Manager.

FOR SALE—Four Purifiers, 28 ft. by 14 ft., with Covers, 15-inch Centre-Valve, Connections, and Lifting Apparatus complete. Also Two PURIFIERS, 34½ ft. by 16 ft., with Covers, two 15-inch Four-Way Valves, Connections, and Lifting Apparatus complete. Bargains to immediate purchasers. Must be removed in April for extensions. Can now be seen at work.

Apply to R. AND J. DEMPSTER, LIMITED, Newton Heath, MANCHESTER.

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.

Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,

Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.

*** See Advertisement p. 517 of this week's issue.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PATENTS, DESIGNS, AND TRADE MARKS.

INVENTIONS Protected by Letters Patent. TRADE MARKS REGISTERED at home and abroad. Advice on all questions relating to above. Handbook gratis.

Apply to J. C. CHAPMAN, Chartered Patent Agent, 70, Chancery Lane, LONDON.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

COUNTY BOROUGH OF BOLTON.
(GAS DEPARTMENT.)

TWO STATION METERS ON SALE.

ON SALE—Two Station Meters, one to pass 40,000 cubic feet of Gas per hour, with 16-inch Connections and Valves, made by Braddock, Oldham; the other, to pass 45,000 cubic feet per hour, with 16-inch Connections and Valves, made by the Gas-Meter Company, Limited. The Meters are now in use, are in good condition, and are being removed to make room for Meters of larger capacity.

Further Particulars may be obtained on application to Mr. William Smith, Gas Engineer, Lum Street Gas-Works, Bolton.

Tenders, endorsed "Station Meters," to be addressed to Alderman Miles, Chairman, Gas Committee, Bolton.
March 15, 1894.

BOROUGH OF BEVERLEY.

THE Gas Committee of the Corporation of Beverley are prepared to receive TENDERS for the supply and erection of CONDENSERS and CONNECTIONS at their Gas-Works, Beverley.

Plans may be seen and Specifications may be obtained on application to the Gas Manager at the Works.

Sealed tenders, marked "Tender for Condensers," to be delivered at my Office on or before Wednesday, the 28th inst.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
JAMES MILLS,
Town Clerk.

March 13, 1894.

TO IRONFOUNDERS AND OTHERS.

THE Gas Committee of the Keighley Corporation are prepared to receive TENDERS for HYDRAULIC MAINS, FOUL MAINS, and RETORT-FITTINGS complete for 180 Mouthpieces.

Drawings can be seen, and Copies of Specification and Quantities obtained, at the Gas Offices, Low Bridge, Keighley, where tenders must be delivered, endorsed "Tender for Retort-Fittings," and addressed to the Chairman of the Gas Committee, on or before Monday, the 26th inst.

By order,
JOHN LAYCOCK.
Engineer.

TO BRICKLAYERS.

THE Gas Committee of the Keighley Corporation are prepared to receive TENDERS for the erection (labour only) of Two RETORT STACKS, of five through Arches each, with Main Flues and Chimney.

Drawings and Specification can be seen at the Gas Offices, Low Bridge, Keighley, where tenders must be delivered, endorsed "Tender for Brickwork," and addressed to the Chairman of the Gas Committee, on or before Monday, the 26th inst.

By order,
JOHN LAYCOCK,
Engineer.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.

OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER LINCOLN."

DRAWINGS, Tracings, Specifications, Quantities, Strains, &c., prepared by an experienced Gas-Engineering Draughtsman. Plans of Works made, copied, or enlarged. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.

Address J. H. OPPENHEIM, 27, FORE STREET, E.C.

TO GAS AND WATER COMPANIES AND MANAGERS.

AN ASSOC.M.INST.C.E. having an extensive experience in GAS and WATER WORKS' DESIGN and ERECTION, now Chief Assistant in a large Gas-Works and Engineer to several small ones, having designed and erected a THREE HUNDRED and a ONE HUNDRED MILLION GAS-WORKS complete, besides several small ones, also ENLARGED many other Works, including NEW LIFTS to EXISTING GASHOLDERS, REGENERATIVE SETTINGS, &c., would be pleased to VISIT WORKS and ADVISE on their EXTENSION or ALTERATION, making SPECIFICATIONS, DRAWINGS, ESTIMATES, and superintend erection if desired.

SPECIALITIES.
Any EXTENSION or ALTERATION to GAS or WATER WORKS. ASSESSMENT of Gas-Works. New HOLDERS, TANKS, ROOFS, PURIFIERS, or FILTER-BEDS. TELESCOPING or adding FRESH LIFTS to EXISTING HOLDERS.
REGENERATIVE SETTINGS, for SMALL GAS-WORKS, without Excavations. SAVING 20 PER CENT. in first cost, renewals, and working.
Address "Boz," 9, Gracechurch Street, LONDON, E.C.

OSWESTRY GAS COMPANY.

TENDERS are invited by the above Company for the supply and delivery at Oswestry of about 450 yards of 12-inch CAST-IRON MAINS and requisite SPECIALS.

TENDERS are also invited for LAYING the above.

Further Particulars may be had from the undersigned.

J. H. PARSONS,
Manager.

SHEFFIELD UNITED GASLIGHT COMPANY.
NEEPSEND STATION.

TO IRON ROOF CONTRACTORS.

THE Directors of this Company invite TENDERS for the construction and erection of a WROUGHT-IRON HIPPED ROOF, 52 feet long by 43 feet span, over Boiler-House at their Neepsend Station.

Copy of the Drawing and Specification may be obtained upon application to the Engineer (Mr. Fletcher W. Stevenson), on payment of 10s. 6d. (not returnable).

Sealed tenders, endorsed "Tender for Roof," must be delivered to the undersigned (by post), at the Company's Offices, on or before Saturday, the 31st day of March.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
March 10, 1894.

SHEFFIELD UNITED GASLIGHT COMPANY.
NEEPSEND STATION.

TO BOILER MAKERS.

THE Directors of this Company invite TENDERS for the manufacture and delivery at their Neepsend Works of three LANCASHIRE STEEL BOILERS, each 30 feet long by 7 ft. 6 in. diameter.

Copy of the Drawing and Specification, with Form of Tender, may be obtained upon application to the Engineer (Mr. Fletcher W. Stevenson), on payment of 10s. 6d. (not returnable).

Sealed tenders, endorsed "Tender for Boilers," must be delivered to the undersigned (by post), at the Company's Offices, on or before Saturday, the 31st day of March.

The Directors do not bind themselves to accept the lowest or any Tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
March 10, 1894.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

CORPORATION OF WARRINGTON.
(GAS DEPARTMENT.)

RETORTS, FIRE-BRICKS, ETC.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of RETORTS, FIRE-BRICK, and FIRE-CLAY.

Tenders, endorsed "Retorts, &c.," must be sent in not later than the 29th inst., addressed to the Chairman, Gas-Works, Warrington.

For further particulars, apply to Mr. W. S. Haddock, Engineer to the Works.

FREDK. TAYLOR,
Secretary.

Gas Offices, Warrington,
March 16, 1894.

TENDERS FOR TAR.

THE Derby Gaslight and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR they will have for disposal during the Twelve Months ending March 31, 1895—viz., 2000 tons.

The Company may dispose of the total surplus of approximately 2000 tons, or part thereof, in one or more contracts, extending over Six or Twelve Months, as the Board may decide; but they do not bind themselves to accept the highest or other tender or tenders.

Tenders must be addressed to the Chairman of the Finance Committee of the Derby Gaslight and Coke Company, Friar Gate, Derby, endorsed "Tender for Tar," and delivered on or before Wednesday, the 28th day of March, 1894.

Further particulars may be had on application.

By order of the Directors,
RICHARD FISHER,
Secretary.

Gas Office, Derby, March 12, 1894.

BRIDGEND GAS AND WATER COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for—

(1) Two STEAM-BOILERS, one HORIZONTAL ENGINE and a pair of Improved BEALE'S Patent EXHAUSTERS, with all Mountings, Valves, and Connections fixed complete.

(2) A WROUGHT-IRON CONDENSER and a CAST-IRON SCRUBBER, with all Valves and Connections fixed complete.

Drawings and Specifications can be seen at the Offices of the Company, Union Street, Bridgend.

Sealed tenders to be sent in on or before the 7th day of April, 1894, addressed to the Chairman of the Company, and endorsed "Tender for Boilers, Engine, and Exhausters," and "Tender for Condenser and Scrubber," as may be.

The Directors do not bind themselves to accept the lowest or any tender.

J. H. DYER,
Secretary and Manager.

Bridgend, March 14, 1894.

TUNBRIDGE WELLS GAS COMPANY.

TO COAL FACTORS AND OTHERS.

THE Directors of the Tunbridge Wells Gas Company will be prepared on Tuesday, the 10th of April next, to receive TENDERS for the supply of 17,000 tons of either NEW PELTON, NEW TANFIELD, PELAW MAIN, EAST PONTOP, SOUTH HETTON, LONDONDERRY, or other approved GAS COALS, at the option of the Directors, to be delivered free into the Gas Company's Siding, on the South-Eastern Railway, at Tunbridge Wells, in accordance with terms and conditions, which may be obtained on application.

The tenders are to be sent to me by not later than Six o'clock p.m., on Tuesday, the 10th of April, marked "Tender for Coals."

The lowest or any tender will not necessarily be accepted.

By order,
JOHN READ,
Secretary.

Gas Company's Office, Tunbridge Wells,
March 16, 1894.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the Half-YEARLY ASSEMBLY of Proprietors will be held at the Company's Office, St. Helen's Place, Bishopsgate, E.C., on Thursday, the 5th of April, 1894, at Twelve o'clock noon precisely, pursuant to Act of Parliament.

The Transfer Books in respect of the Ordinary Stock will be closed on the 22nd of March, and reopened on the 12th of April, on which day the Dividends on this Stock will be payable.

By order,
I. A. CROCKENDEN,
Secretary.

St. Helen's Place,
March 14, 1894.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given, that an ORDINARY MEETING of the Commercial Gas Company will be holden at the Cannon Street Hotel, in the City of London, on Thursday, the 5th of April, 1894, at Twelve o'clock at Noon—

To receive the Report of the Directors,
To declare a Dividend,
To elect Directors and an Auditor in the place of those retiring,
And for other business.

The Stock Transfer Books will be closed from the 23rd of March inst. to the 5th of April next, both days inclusive.

By order of the Board,
H. D. ELLIS,
Secretary.

Offices, Stepney,
March 14, 1894.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
B Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY
FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

London Office:
90, CANNON STREET, E.C.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

JAMES WHITE & CO., LTD.,

WIDNES, LANCASHIRE,

Manufacturers of Special

FIRE-BRICKS, FIRE-CLAY, & FURNACE CEMENT.

FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best and most durable in the Market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest Quality.

FURNACE CEMENT specially made for repairing Furnaces and stopping Cracks.

ANALYSIS AND REFERENCES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

THORNLEY GAS COALS

WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.
GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	PER CENT.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

TELEGRAPHIC ADDRESS: "ROBUSTNESS, LONDON." EXCHANGE TELEPHONE 1756.

GASEOUS FIRING

FOR LARGE OR SMALL

RETORT-SETTINGS

PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED.

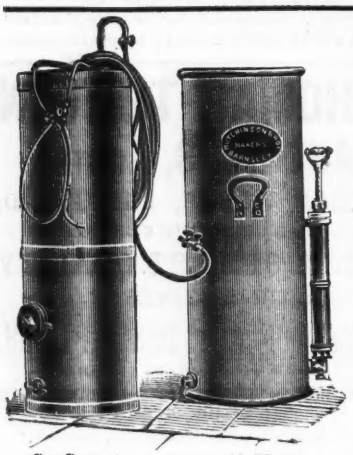
SPECIALTIES

J. & H. ROBUS,

20, BUCKLERSBURY, LONDON, E.C.

ENGINEERS & CONTRACTORS

FOR THE ERECTION OF GAS AND WATER WORKS COMPLETE, AND FOR EXTENSIONS AND RENEWALS.



Gas-Generator Air-Blower.
IMPROVED LEAD-BURNING APPARATUS

HUTCHINSON BROS.,

GAS ENGINEERS, &c.

SPECIALITY.

LEAD WORK FOR SULPHATE OF AMMONIA PLANTS,

BEST QUALITY OF MATERIAL AND WORKMANSHIP.

SATURATORS, all Lead, or Strong Sheet Lead, in Wood Casing

ACID TANKS, ELEVATORS, AND COCKS. LIQUOR AND LIME PUMPS OR INJECTORS.

Liquor-Cocks, Gauge Fittings, and Safety-Valves in Cast Iron.

HYDROMETERS, TEST-JARS (GLASS OR LEAD), COPPER SCOOPS, &c., &c.

IMPROVED LEAD-BURNING APPARATUS.

LEAD BURNERS SENT OUT TO REPAIRS.

FALCON WORKS, BARNSLEY.

Telegrams: "HUTCHINSON BROS., BARNSLEY."

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

HUNTER'S
OXIDE OF IRON.
JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF
NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

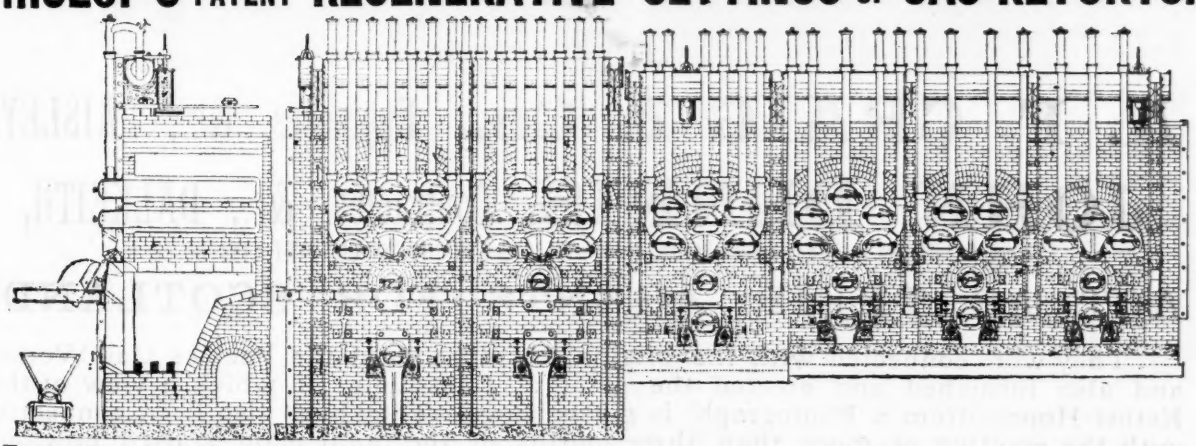
UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

G. WALLER & Co.'s NEW PATENT GAS EXHAUSTER
MADE WITH FOUR BLADES,
To pass 300,000 Cubic Feet per Hour, with or without Engine combined.
IN USE AND ON ORDER FOR OVER 100 WORKS,
AND EQUAL TO
5,340,000 CUBIC FEET PER HOUR.

SPECIAL ADVANTAGES:—
The Four-Blade Exhauster **PASSES 50 PER CENT. MORE PER REVOLUTION** than any One or Two Blade Exhauster.
It takes 27 per cent. less power than any Two-Blade Exhauster.
It gives a **STEADIER GAUGE** than any other Exhauster.
One of our 150,000 feet per hour Patent Four-Blade Exhausters passes continuously **180,000** cubic feet per hour, driven by a **12-INCH STEAM CYLINDER.** No other Maker can give a similar result.
Model of Patent Exhauster sent for inspection.
Oldest Makers of **BEALE EXHAUSTERS** for over 300 Works.
Patent Compensating Steam Governor, Special Tar and Liquor Pumps, Gas-Valves.
Washer-Scrubbers, with **WOOD CLUSTERS**, and Tar Extractor combined.

PHŒNIX ENGINEERING WORKS,
PARK STREET, SOUTHWARK, LONDON, S.E.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN VERY EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.
THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS
Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.
Descriptive Pamphlets and Terms from Agents as above.

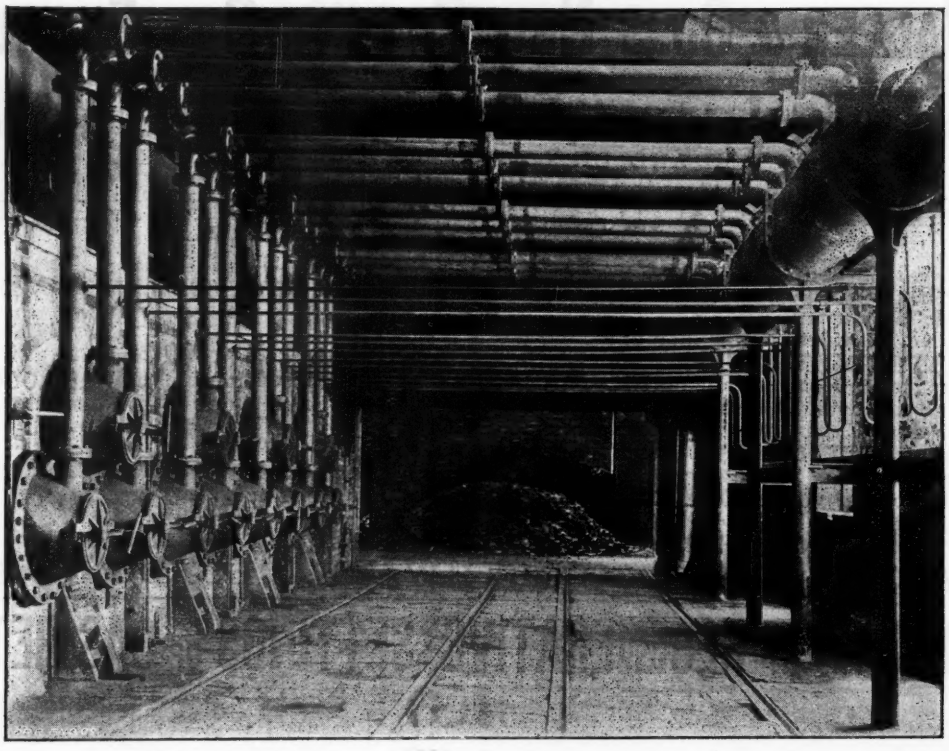
THE OIL-GAS ENRICHMENT COMPANY, Limited.

Registered Office: 28, Queen Street, Edinburgh. J. GORDON MASON, Solicitor, Secretary.

THE

PEEBLES OIL-GAS PROCESS

(YOUNG & BELL'S PATENT.)



A. F. CRAIG & Co., Engineers, &c., PAISLEY,

AND

JOHN DENNIS, Contractor, &c., DALKEITH,

beg to intimate that they are authorized by the OIL-GAS ENRICHMENT COMPANY, LIMITED, to

ACT AS THEIR AGENTS FOR SCOTLAND.

They were connected with the original Installation at the Peebles Gas-Works, and also furnished and erected the plant at Galashiels, of which a view of the Retort-House (from a Photograph) is given above. They have also been connected with the erection of more than three-fourths of the total plant started previous to 1894, including that at Peebles and Galashiels (previously mentioned), Kelso, Musselburgh, Alloa, Innerleithen, Dalkeith, Penicuik, Lasswade, &c., all of which are giving the utmost satisfaction.

Having thereby gained considerable experience, they are now in a position to furnish particulars regarding the enriching of Coal Gas from Oils and Tars, in accordance with the "PEEBLES PROCESS," the success of which has now been thoroughly proved.

They will be glad to prepare Drawings and give Estimates for supplying and erecting complete the necessary plant for the manufacture of Gas from Oils and Tars alone, or for the adaptation of the Oil-Gas Enriching Process to work in combination with existing Coal Gas Plant.

They hope to be favoured with inquiries from all those considering the adoption of this process in Scotland. All orders with which they are entrusted shall receive their best attention.

FOR FURTHER PARTICULARS, ESTIMATES, &C., ADDRESS EITHER OF THE ABOVE FIRMS.

GAS AND WATER PIPES.

Telegraphic Address: "RITCHIE MIDDLESBROUGH."

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON.

Wrought-Iron

And Fittings and Accessories.

LAMBERT BROS., WALSALL,

MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.
BRASS GAS-FITTINGS GAS-VALVES, STEAM & WATER VALVES TOOLS, &c. AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Short Street, LAMBETH.

WHY BUY **CANNELS** AND **HIGH-PRICED COALS**

WHEN, BY ERECTING A SMALL PLANT ON THE

"PEEBLES" PRINCIPLE,

YOU CAN PRODUCE A **PERMANENT OIL GAS,** AND, BY ADDING A SMALL PERCENTAGE, ENRICH INFERIOR COAL GAS TO

ANY ILLUMINATING POWER?

WHY ACCEPT LOW PRICES FOR TAR WHEN THE

SAME PLANT WILL CONVERT YOUR **TAR**

INTO AN ENRICHING GAS?

BEFORE ENTERING INTO CONTRACTS FOR COAL, CANNEL, OR TAR,

WRITE FOR PARTICULARS OF THE **"PEEBLES PROCESS"**

TO **R. & J. DEMPSTER,** LIMITED,

NEWTON HEATH, **MANCHESTER.**

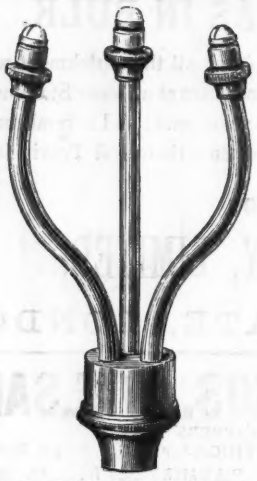
LONDON OFFICE: **181, Gresham House, Old Broad St., E.C.**

GOODSON'S

CELEBRATED PATENT

GAS GOVERNORS AND BURNERS.

Approved of by the principal CORPORATIONS, GAS COMPANIES, and LAMP MAKERS at Home and Abroad.



THE LONG COMBINATION.

THE ARGAND
For Gas-Stoves, &c.

THE STREET-LAMP GOVERNOR.

OUTLET.

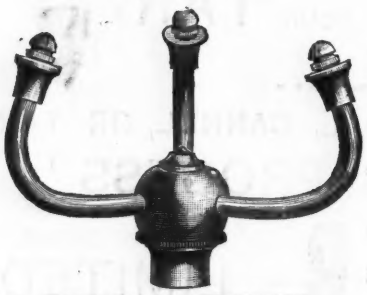
THE "ASCENSION."

FOR OTHER DESIGNS SEE LIST.

12s. per Dozen.

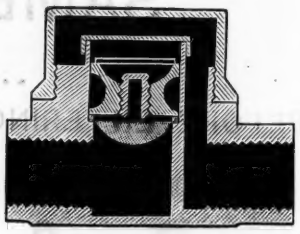
INLET.

THE "DESCENSION."



THE SHORT COMBINATION.

THE "GLOSTER."



INLET. OUTLET.

THE HORIZONTAL.

PRICE LIST WITH TRADE TERMS ON APPLICATION.

GOODSON & CO.,

213, VAUXHALL BRIDGE ROAD, LONDON, S.W.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

CLAYTON SON & Co LTD

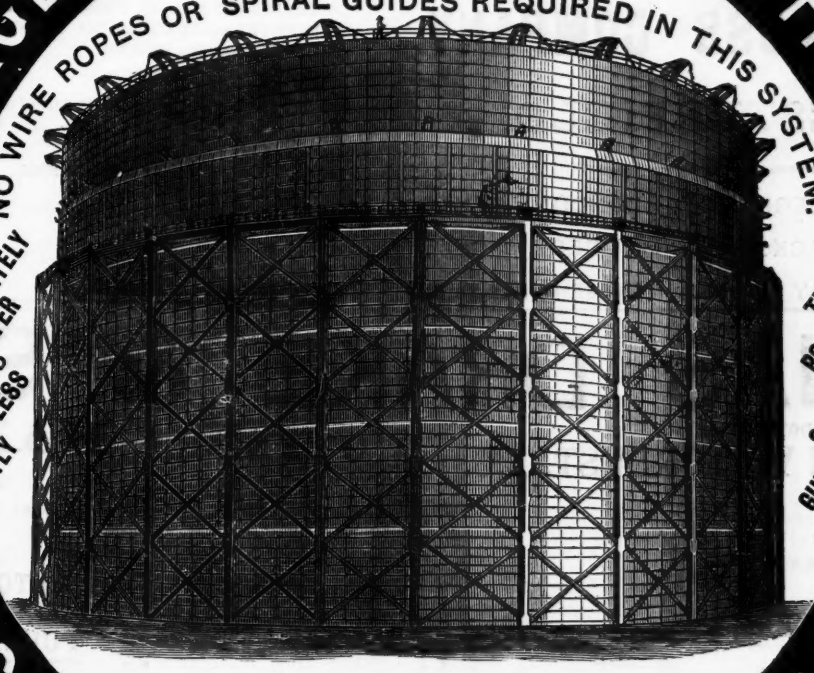
MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.



INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.

CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

MAKERS OF GAS PLANT OF EVERY DESCRIPTION
ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."
GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,
CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
CXC	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, GT. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S
IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO

GODDARD, MASSEY, & WARNER,
ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

JONAS DRAKE & SON,

LONDON OFFICE:
60, QUEEN VICTORIA ST., E.C.

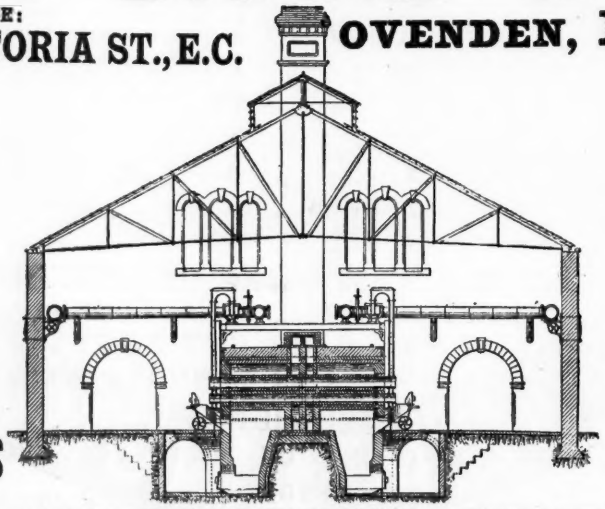
OVENDEN, HALIFAX.

TELEPHONE No. 48.
HALIFAX EXCHANGE.

TELEGRAPHIC ADDRESSES:
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON."

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S, VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

GASEOUS FIRING A SPECIALTY.

GIBBONS BROS., DUDLEY.

Telegraphic Address: "GIBBONS, DUDLEY."

Telephone No. 8013, DUDLEY EXCHANGE.

GAS ENGINEERS & CONTRACTORS,

BUILDERS AND ERECTORS OF ALL DESCRIPTIONS OF INCLINED RETORTS, GENERATOR AND REGENERATOR SETTINGS, COMPLETE WITH ALL IRONWORK.

PATENT GENERATOR SETTINGS.

GIBBONS & MASTERS' PATENT No. 1269.

Pamphlet, with Illustrations of this Setting, together with Testimonials, will be forwarded on application, together with detail Drawings, Specification, and Prices.

THIS SETTING HAS BEEN ADOPTED, AND IS SUCCESSFULLY WORKING AT THE FOLLOWING GAS-WORKS:—

LEAMINGTON	1	BED	OF 6	RETORTS,	SET	DECEMBER, 1892.
,,	1	,,	,, 6	,,	,,	FEBRUARY, 1893.
,,	4	BEDS	,, 6	,,	,,	MARCH, 1893.
,,	6	,,	,, 6	,,	,,	OCTOBER, 1893.
LUTON	2	,,	,, 6	,,	,,	DECEMBER, 1892.
,,	3	,,	,, 6	,,	,,	SEPTEMBER, 1893.
LITTLEHAMPTON	1	BED	,, 4	,,	,,	MAY, 1893.
BEDFORD	1	,,	,, 7	,,	,,	APRIL, 1893.
,,	1	,,	,, 7	,,	,,	SEPTEMBER, 1893.
KENILWORTH	1	,,	,, 5	,,	,,	JULY, 1893.
,,	1	,,	,, 3	,,	,,	JULY, 1893.
BANBURY	2	BEDS	,, 6	,,	,,	JUNE, 1893.
WORTHING	1	BED	,, 6	,,	,,	MAY, 1893.
,,	1	,,	,, 6	,,	,,	JULY, 1893.
HORSHAM	1	,,	,, 7	,,	,,	SEPTEMBER, 1893.
ASHTON-IN-MAKERFIELD	1	,,	,, 5	,,	,,	OCTOBER, 1893.
LUTON	ORDER ON HAND FOR SIX ADDITIONAL BEDS OF SIX RETORTS.					
CHERTSEY	ORDER ON HAND FOR EIGHT BEDS OF SIX RETORTS.					

* SEVERAL OTHER INQUIRIES ON HAND. *

Gas Lamps and Posts.

Patent Street Lamps.

NO PUTTY.

Several thousands of these are now in use, giving general satisfaction. They are strongly made, and of best material.

Lamplighters' Torches.

Lever Taps.

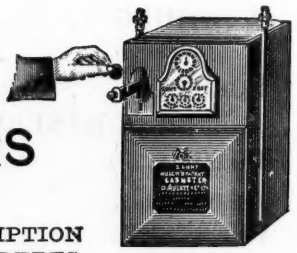
Lamp Governors.

PRICE LIST ON APPLICATION.

SPECIAL HIGH-POWER LAMPS.

For Lighting Streets, Refuges, Promenades, &c., where a good light is required. Fitted with Porcelain cone, Copper top and perforation, Wrought-Iron Spray, Lever Tap, Burner and Patent Governor, glazed with Opal top.

GAS-METERS.



PREPAYMENT METERS

(PRICE'S PATENT)

SPECIALLY ADAPTED FOR INCREASING CONSUMPTION AMONG SMALL CONSUMERS. NO RISK OF BAD DEBTS.

D. HULETT & Co., Ltd.,

55 & 56, HIGH HOLBORN, LONDON.

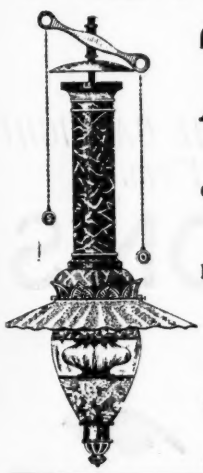
HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

ARROL-FOULIS
Patent Automatic Machinery
FOR
DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
GLASGOW.
See Illustrated Advertisement, p. II. Centre of JOURNAL for Mar. 6.

The Climax of Regenerative Gas Lighting!!



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A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England by
HENRY GREENE & SONS,
153 & 155, CANNON STREET, LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

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INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

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RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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BEST QUALITY.
KING BROTHERS, STOURBRIDGE.
[See Illustrated Advertisement, March 6, p. 421.]

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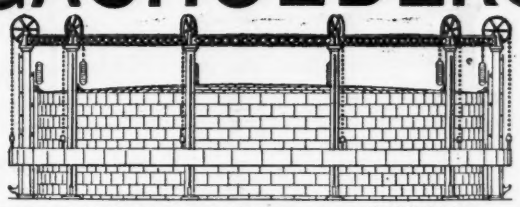
MANUFACTURERS
OF GASELIERS
IN GLASS AND METAL.

HENRY BALFOUR & CO.,
LEVEN, FIFE,
MAKERS OF
GASHOLDERS



PRESSURE-REGULATORS FOR GASHOLDERS (See "JOURNAL" Dec. 20, 1892.)
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Contractors for the Erection of Gas-Works Complete,
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LIMITED,
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RETORT LIDS
OF ALL FORMS AND SHAPES
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BY SPECIAL HYDRAULIC MACHINERY.
PRICES ON APPLICATION.

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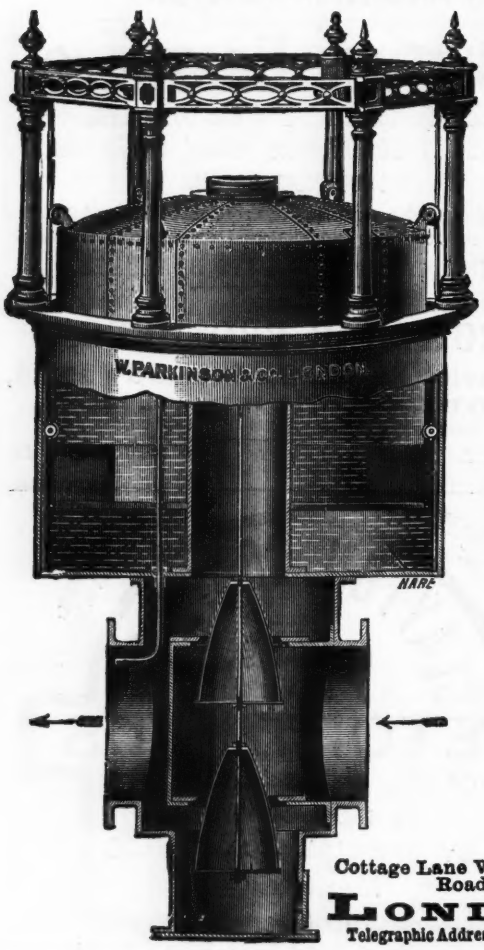
All the Meters (which number 14) at the Beckton Station of THE GASLIGHT AND COKE COMPANY have been erected by the above Firm.



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MANCHESTER.
Telegraphic Address: "Precision."
[See also Advt. p. 518.

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